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Waste Analysis Plans
A Guidance Manual

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Waste Analysis Plans

A Guidance Manual

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The purpose of this manual is to provide guidance to both permit applicants and reviewers/writers on how to prepare and evaluate waste analysis plans. By following the guidance in this document, a permit applicant should be able to develop a waste analysis plan that satisfies the intent of the regulations and that can be reviewed easily by permitting official

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WASTE ANALYSIS PLANS

A Guidance Manual

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2<

CONTENTS

1. Introduction to Manual 1

2. Regulatory Requirements 2

3. Preparing a Waste Analysis Plan 3

4. Checklists for Writing or Reviewing Waste Analysis Plans 15

References 24

Appendices

A. 40 CFR 264.13 General Waste Analysis . . . . A- 1

B. Example Waste Analysis Plans . . . . B- 1

Container Storage

Tank Storage

Surface Impoundment

Waste Pile

Land Treatment

Incineration

Chemical Treatment

Landfill

References

C. How to Use a Random Numbers Table for Waste Sampling . . . . . . C- 1

D. Drummed Wastes - Estimating Sampling Size . . . . D- 1

E. A Ranking Exercise to Select Frequency of Waste Recharacterizations . . . . E- 1

3<

TABLES

Number Page

4-1 Waste Analysis Plan Checklist - General Information 16

4-2 Waste Analysis Plan Checklist - Specific Hazardous Waste Management Process 19

4-3 Optional Items to Consider When Preparing a Waste Analysis Plan 22

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1. INTRODUCTION TO MANUAL

The Resource Conservation and Recovery Act (RCRA) was passed by Congress to assure the proper treatment, storage, and disposal of hazardous wastes. As a result of this Act, RCRA permits are required for hazardous waste management facilities. Such permits are issued to those management facilities that can demonstrate an ability to safely and effectively manage specific hazardous wastes or waste categories. The EPA document "Permit Applicants' Guidance Manual for the General Facility Standards of 40 CFR 264" (SW-968) provides general guidance on preparing the various sections of a RCRA Part B permit application.

An important aspect of hazardous waste management is the process by which the information needed to manage the wastes is obtained. One of the requirements of the Federal regulations is that this process be set forth in a waste analysis plan and submitted as part of the RCRA permit application. The waste analysis plan should describe how one decides what information is needed, the nature and extent of the information needed, and the method by which the information will be gathered.

The purpose of this manual is to provide guidance to both permit applicants and reviewers/writers on how to prepare and evaluate waste analysis plans. This manual provides--

- an explanation of the RCRA regulations that require a waste analysis plan,
- a discussion of the purpose and objectives of a waste analysis plan and a recommended approach for preparing a plan,
- checklists to assist the preparer/reviewer in assuring that the analysis plan is complete, and
- example waste analysis plans for various hazardous waste management scenarios.

By following the guidance in this manual, a permit applicant should be able to develop a waste analysis plan that satisfies the intent of the regulations and that can be reviewed easily by the permitting official.

2. REGULATORY REQUIREMENTS

Title 40 of the Code of Federal Regulations, Part 264.13 establishes the requirement for a waste analysis plan and describes the information that is required in such a plan (see Appendix A). These regulations are applicable to all types of hazardous waste management facilities. In addition to the above general requirements, management-specific requirements are described in the following sections of the regulations:

40 CFR 264.170 to 264.178	Containers (Subpart I)
40 CFR 264.190 to 264.199	Tanks (Subpart J)
40 CFR 264.220 to 264.230	Surface Impoundments (Subpart K)
40 CFR 264.250 to 264.258	Waste Piles (Subpart L)
40 CFR 264.270 to 264.282	Land Treatment (Subpart M)
40 CFR 264.300 to 264.316	Landfills (Subpart N)
40 CFR 264.340 to 264.351	Incinerators (Subpart O)
40 CFR 265.370 to 265.382	Thermal Treatment (Subpart P)
40 CFR 265.400 to 265.406	Chemical, Physical, and Biological Treatment (Subpart Q)

The waste analysis plan regulations distinguish between two types of hazardous waste management facilities:

- *Onsite facility*--the facility that manages only those hazardous wastes that are generated on its own geographic site (see 40 CFR 260.10 for more information), and

- *Offsite facility*--the facility that receives and manages hazardous wastes that are generated outside the site in question.

Certain parts of the waste analysis plan requirements pertain to all hazardous waste management facilities while others apply only to offsite facilities.

While the regulations governing waste analysis plans are extensive and complex, their objectives are simple. These are--

1. to ensure that sufficient information is available to determine whether the wastes considered for management at a hazardous waste management facility fall within the scope of the facility's permit,

   and

2. to ensure that the facility has sufficient information about the wastes to properly manage the wastes once they are accepted.

To comply with the regulations, each waste analysis plan must address the procedures that will be followed to accomplish these objectives.

3. PREPARING A WASTE ANALYSIS PLAN

3.1 OBJECTIVE AND PURPOSE OF PLAN

The objective of a waste analysis plan is to describe the procedures that will be undertaken to obtain sufficient waste information to operate a hazardous waste management facility in accordance with its permit (i.e., to ensure that wastes accepted by the facility fall within the scope of the facility's permit, and that the process performance standards are met). The waste analysis plan establishes the hazardous waste sampling and analysis procedures that will be routinely conducted as a requirement of the RCRA permit. If the plan is followed properly, any waste-related discrepancies with the permitted management activities will be identified before waste management begins. These objectives are the same for both onsite and offsite facilities. However, the Agency believes that a waste generator owned and operated facility will tend to know more about the waste generation process than would a facility not owned and operated by the waste's generator. Thus, offsite facilities are required by the regulations to conduct more frequent checks on wastes than onsite facilities.

A waste analysis plan should demonstrate to EPA or State permitting officials that the facility owner/operator knows what information is needed to operate the facility properly and has in place a program to gather the necessary information. Once the plan is approved, it will serve as an operating plan for waste sampling and analysis.

3.2 CONTENT AND ORGANIZATION

The RCRA regulations do not require a specific format for the waste analysis plan. For ease of review, however, the plan should be organized to present the reviewer with the required information in a logical manner. Applicants may thus want to organize the application in such a manner that the description of the facility or process to be permitted is clearly identified. Sufficiently detailed information will be needed by the permit application reviewer to judge the degree to which the plan addresses the following questions.

I. What are the specific wastes or types of wastes that will be managed within each process?

II. What are the waste-associated properties that are of concern in ensuring safe and effective management (e.g., kcal/g (Btu) content, % water)?

III. What are the specific waste parameters that have to be quantified in order to satisfy the data needs?

IV. How will the necessary data be obtained, including what sampling and analysis procedures, and what attendant quality control/quality assurance procedures are to be carried out by the permitee?

8<

It is recommended that a waste analysis plan be organized based on these four questions. The plan's organization should be keyed to the decision/review process, presenting the logical approach and decision tree used by the permit applicant in arriving at answers to each data need question. It should be designed to lead the reviewer through the thought process employed by the applicant.

Usually other portions of the RCRA permit application will contain an indepth description of the facility and the processes to be permitted. Those sections will establish the types and the characteristics of wastes to be managed and any process constraints. The waste analysis plan should reference these other sections of the application, and it is suggested that the applicant summarize those points that are particularly germane to the plan in order to assist the reviewer and user.

3.3 ABBREVIATED EXAMPLE PLAN

In order to illustrate how the above questions might be addressed in a logical, easy to understand manner, an abbreviated example of portions of a waste analysis plan follows. This example is not intended to represent an actual facility plan. Examples of representative plans for various types of facilities are presented in Appendix B.

The sections of the example plan that follow the Facility Description are written from the perspective of an applicant and discuss areas that would have to be addressed in any waste analysis plan.

Facility Description

An offsite facility requesting a RCRA permit for its hazardous waste incinerator will be assumed in this example. The facility would receive wastes in both drums and tank trucks and would store the waste in either the receiving drums or in large blending tanks until sufficient waste was on-hand for an incinerator run.

A permit is being requested for a facility which would be allowed to burn liquid wastes containing up to 5 percent organochlorine content, as long as the wastes accepted contain PCBs at <50 ppm, dioxin at <1 ppb, or chromium at <5 ppm.

Identification of Wastes to be Managed

Issues to be Addressed	Response
What wastes do we want a permit to manage?	Liquid wastes or wastes that can be made pumpable by blending or heating.

What wastes can we not handle and thus need to be prevented from being accepted?	PCB-containing materials (>50 ppm). Dioxin-containing materials (>1 ppb chlorinated dioxins). Chromium wastes (>5 ppm Cr).

Process Tolerance Limits

What waste properties do we need to be concerned with to ensure that the incinerator operates within the permit envelope?	Constituents in the incinerator waste feed must have heats of combustion of at least 4.44 kcal/g (8,000 Btu/lb). This value is based on the heating value of the POHC used in the trial burn test. Feed to the incinerator must be a liquid with less than 85% water to maintain burning efficiency. Waste feed must have less than 5% organochlorine and an ash content of less than 40% to comply with emissions standards.

Waste Parameters to be Monitored

What parameters will be measured to ensure that the above properties are maintained?	Heat of combustion Viscosity Water content Ash content Organochlorine content EP metals content Compatibility with materials of construction. Compatibility with other wastes that it may contact. [Applicant should also include rationale for selection of each parameter.]
How will we avoid accepting wastes which are outside the facility's permit?	Prior to agreeing to accept waste from a generator, the client will be required to submit the following information about the waste, including ranges for each property to be expected in routine production: Heat of combustion Viscosity

10<

Water content
Ash content
Reactivity
Ignitability (flash point)
Corrosivity
Acidity or alkalinity
EP metals concentrations
Major inorganic constituents
Total organic carbon
Major organic constituents
  and their heats of combustion
PCB
Dioxin
Instability properties

If any of the properties fall outside of the acceptable characteristics described under "Wastes To Be Managed," the waste would be refused.

For those wastes provisionally accepted, the client would be required to submit and certify a representative sample of the waste(s). This sample will be analyzed by XYZ Laboratory to confirm the data submitted by the client.

If the properties are within our specifications, the waste would be deemed acceptable for treatment.

[Applicant should indicate frequency of recharacterizing generator's wastes.]

How will incoming shipments be screened to ensure that they are as manifested and are ones that we have agreed to accept?

A series of fingerprint properties characteristic of each waste would be selected, and used to screen each incoming shipment before the waste is accepted at the facility.

If the fingerprint analysis finds an unacceptable discrepancy, the waste will be analyzed further and either returned to the client or sent to a facility permitted to accept such wastes.

Waste Sampling, Analysis, and Quality Assurance/Quality Control Procedures

How will the wastes be sampled to ensure representativeness of samples tested?	Since only liquid wastes are to be accepted, drums will be sampled using a Coliwasa device. Drums will be sampled depending on the number of drums in each lot received. The number of drums sampled will be based on the cubed root equation. [See Appendices C and D of this manual for further information.] If out of specification drums are found, all remaining drums in that shipment will be sampled prior to acceptance. Each tank truck will be sampled using a Coliwasa if a suitable sampling port is available. If such a port is unavailable, the waste will be pumped into a holding tank and a composite sample collected during pumping.
What specific test methods will be used to measure each parameter?	Heat of combustion - ASTM[1] D240 Viscosity - ASTM D1824 Water content - ASTM D95 Ash Content - APHA[2] 209E Reactivity - SW-846[3] Section 2.1.3 Ignitability - SW-846 1010/1020 Corrosivity - SW-846 1110 and/or 9040 EP metals - SW-846 Arsenic - 7060 Barium - 7081 Cadmium - 7131 Chromium (VI) - 7195 Lead - 7421 Mercury - 7470 Selenium - 7740 Silver - 7761 Major inorganic constituents - SW-846 6010

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[1] ASTM American Society for Testing and Materials.

[2] APHA American Public Health Association Standard Methods for the Examination of Water and Wastewater 1980.

[3] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

	Total organic carbon - APHA 505 Major organic constituents - SW-846 8010-8150 (based on suspected constituents) PCB - SW-846 8080 Dioxin - SW-846 8280 Instability properties - Dupont DTA [Method would be described in an appendix]
What quality assurance/quality control procedures will be followed for sampling and analysis?	Quarterly review of staff skills in sampling and analysis. Maintaining a field log of samples taken. Labeling samples. Following SW-846 QA/QC procedures for each test method. Inspection and maintenance of sampling and analytical equipment. Documentation and filing of all sampling and analysis information.

3.4 DISCUSSION OF THE PLAN INFORMATION NEEDS

Facility Description

Before the reviewer can evaluate the adequacy of the proposed testing, the permit applicant needs to identify the waste management processes that operate at the facility. Enough information is needed concerning what wastes can and cannot be properly managed by their facility so that the application reviewer can judge whether the testing proposed is adequate.

While this information will generally be exhaustively described and discussed in other sections of the permit application, it would be useful to include a summary of this information in the waste analysis plan since the plan may later serve as an operating manual during facility operation. In addition, it is helpful to application reviewers to have a waste analysis plan that stands alone.

Identification of Wastes to Be Managed

This section of the plan should include--

- a list of the wastes or waste types that the applicant wants to be permitted to manage in each process operating at the facility,
- a list of any wastes known not to be manageable, and
- known waste properties which, if exhibited by the waste, would preclude the waste's acceptance at the facility.

This information is necessary to evaluate the adequacy of the proposed testing program. If the applicant chooses, the information may be placed in other parts of the permit application. However, incorporation of this information in the waste analysis plan will make the application easier to review and also allow the plan to stand alone and be used as an operating manual.

Before conducting extensive testing to determine the waste properties that might be acceptable for management at a given type of facility, the applicant may want to refer to EPA background documents or other sources on the specific waste or management process of interest. In addition to EPA background documents, other sources of information include published scientific or engineering literature; data from trial tests and waste analyses; and previous experiences. For example, 40 CFR Part 261, Appendix VII enumerates major hazardous constituents in each RCRA listed waste. "A Method for Determining the Compatibility of Hazardous Wastes" (EPA-600/2-80-076) provides helpful information on compatibility of chemical classes and their relation to industry. This supplemental information may help identify what waste information should be obtained by analysis and what analytical methods to use.

At this point it is appropriate to introduce the "boundary condition" concept that will be used in the example waste analysis plans in Appendix B. Boundary conditions are the maximum and minimum values of waste properties which, if exceeded, would alert the operator that the waste does not meet its typical properties and requires further attention before acceptance.

Process Tolerance Limits

A second concept that will be used in the example plans is that of "tolerance limits." Tolerance limits represent those characteristics of a waste or waste mixture that a waste management process can handle while maintaining permit compliance. These limits can be quantitative or qualitative. The tolerance limits are generally linked to the performance goals of the waste management process. The waste analysis plan should address these tolerance limits and describe the rationale for their selection.

Tolerance limits may thus be based on considerations of--

- the efficiency at which the process is designed to operate (e.g., 99.99% destruction and removal efficiency for incineration), and
- potential incompatabilities between new wastes and the process raw materials, structure, and currently managed wastes.

Questions that might need to be answered about process limitations are, for example--

- How much supplemental fuel will have to be blended with the waste for proper incinerator operation?

- How much lime needs to be added for proper neutralization?
- What storage tank construction materials are compatible with the waste?
- What pretreatment if any is needed before waste management processing?

Waste Parameters to be Monitored

This section addresses--

- waste parameters to be analyzed for characterization and the rationales for parameters selected,
- frequency of recharacterization, and
- waste shipment screening and key ("fingerprint") parameters for screening.

Waste Characterization

Waste parameters must be selected to represent those characteristics necessary to manage the waste in compliance with permit conditions. The rationale for selecting each parameter, addressing how well the parameter represents the information needed for compliance, should be described in the waste analysis plan.

Waste analysis parameters should be selected after 1) reviewing existing information on the waste properties (e.g., 40 CFR 261 Appendix VII, EPA listing and delisting background documents, process engineering studies, industry association waste characterization studies), 2) noting what properties best indicate any change in a waste's composition, and 3) comparing this information to the facility's design criteria and, if appropriate, trial treatment test results.

Waste analysis plans need to include procedures for complying with the specific waste management requirements described in 40 CFR 264.17 and 264.341. 40 CFR 264.17 addresses three waste parameters: ignitability, reactivity, and incompatibility. Incompatible wastes, if brought together, could result in heat generation, toxic gas generation, and/or explosions. A waste analysis plan must therefore address measures to identify potentially ignitable, reactive, and incompatible wastes. Standard tests to identify ignitable wastes can be found in Section 2.1.1 of "Test Methods for Evaluating Solid Waste" (SW-846). Reactive wastes are also defined in this document, although standard tests are not yet available to measure the reactivity of all wastes. Waste compatibility experiments can serve to establish compatibility between wastes of interest for a given process. An EPA document, "A Method for Determining the Compatibility of Hazardous Wastes" (EPA-600/2-80-076), contains procedures to evaluate qualitatively the compatibility of various categories of waste. Standard compatibility tests have not been published to date by EPA.

40 CFR 264.341 addresses waste information required for incineration facilities. Waste analysis plans for incineration facilities should include routine analyses of waste parameters that are required as a result of a trial burn. Trial burns (or comparable information) are required before such a facility is permitted to operate. A "trial burn plan," required for these test runs, includes analyzing each hazardous waste to be incinerated for certain hazardous constitutents listed in 40 CFR 261, Appendix VIII (i.e., Principal Organic Hazardous Constituents (POHCs). The analytical data serve as references for measuring incineration performance. A comparison of hazardous waste constitutent concentrations before incineration to the levels emitted from the incinerator allows the calculation of the destruction and removal efficiency. This information provides a measure of how efficiently the facility is destroying and removing the hazardous waste. Additional information requirements for specific hazardous waste management processes can be found in Section 4, "Checklists for Writing or Reviewing Waste Analysis Plans." EPA's "Guidance Manual for Hazardous Waste Incinerator Permits" (SW-966) also elaborates on waste analyses and trial burns. However, to obtain information on current EPA test methods, refer to SW-846.

Recharacterization

Since consistent performance in a hazardous waste management process is important, hazardous wastes may need to be characterized periodically in more detail than is involved in "fingerprint analysis" (analyzing for a few key parameters). Such detailed analysis (*recharacterization*) serves to detect any changes in the concentrations of chemical constituents, the appearance of new constituents, or variations in physical properties. An owner or operator must recharacterize a waste when its generation source has changed in order to identify any changes in waste characteristics. Such a change in generation sources may result from engineering modifications or from malfunctions/changes in operation. While the generator should notify the waste management facility operator of such occurrences, the owner/operator, particularly for an offsite facility, should set up a program to look for waste changes that may occur even without any notification from the generator. Appendix E of this manual presents a method for selecting the frequency of waste recharacterization. It is aimed at offsite facilities but can be easily modified for use by onsite facilities.

Shipment Screening

Offsite hazardous waste management facilities are required by 40 CFR 264.13 to comply with additional regulations that help minimize the potential for incorrectly identified and unacceptable waste shipments being handled. The offsite facility waste analysis plan must specify the waste analysis data that the generator of the waste provides. It is important that the plan describe the procedures to be taken by the facility owner/operator in order to determine how well the generator's data represents the waste to be managed.

Since the owner/operator of the offsite facility is not able to monitor waste generation operations daily, the exact waste characteristics of each shipment will not be known. Hence, an offsite facility must, at a minimum, visually inspect and compare the contents of each shipment to the accompanying manifest to identify the waste. The shipment is sampled and analyzed only to the extent necessary to verify that it meets permit waste specifications (fingerprint analysis). An owner or operator must recharacterize a waste when a shipment does not match the manifest description. Shipment screenings may also be necessary for onsite facilities particularly when the facility receives a variety of wastes. The level of screening to be required for an onsite facility is a function of the facility operator's knowledge about the generation process.

Typically, waste shipments are sampled and analyzed for a few key chemical and physical parameters. These *key parameters* are selected from the initial waste characterization parameters measured before the owner/operator agrees to handle the generator's waste. The parameters should reflect characteristics that substantiate the waste composition as described in the RCRA permit. Criteria that one might consider when selecting key parameters are:

- the need to identify restricted wastes,
- parameters representative of the incinerator's chemical/physical design criteria and performance,
- the potential ignitability, reactivity, or incompatibility of the wastes, and
- parameters that best indicate changes in waste characteristics.

While fingerprint parameters are often a subset of characterization parameters, this may not always be the case. For example, one may use screening tests to detect constituents that are not normally present in the waste even though the tests do not identify the specific contaminant. The Agency does not currently have an approved set of test procedures for such purposes. However, reference might be made to "Test Methods for Evaluating Solid Waste" (SW-846) and "Design and Development of a Hazardous Waste Reactivity Testing Protocol" (EPA-600/52-84-057) for suggested fingerprint analysis procedures.

Selecting a few key parameters for analysis of each shipment ("fingerprinting") expedites waste characterization, which is important because of the time and labor involved in receiving shipments. The test methods for these key parameters are based on the initial waste characterization test methods which are described in "Test Methods for Evaluating Solid Waste" (SW-846) and other EPA publications. Any changes in waste characteristics that could affect the performance of the hazardous waste management process should be detectable by conducting these tests.

Waste Sampling, Analysis, and Quality Assurance/Quality Control Procedures

This section of the plan includes--

- waste sampling procedures,
- waste analysis methods, and
- their related quality assurance/quality control procedures.

Appendix I of 40 CFR Part 261, Representative Sampling Methods, describes standard sampling methods developed by the American Society for Testing and Materials (ASTM) and others that can be used when sampling hazardous waste. Discussions on representative sampling and descriptions of sampling devices are also available in the EPA document "Test Methods for Evaluating Solid Waste" (SW-846). Appendix C of this manual addresses random sampling and demonstrates how to use a random numbers table for waste sampling. Appendix D contains the ASTM method for estimating the number of containers to sample. The permit applicant should contact the application reviewer if he or she is uncertain about how to estimate the number of samples to take. If wastes cannot be sampled by the standardized methods and approved devices, the applicant must develop a suitable sampling method and include a detailed description and rationale for the method in the waste analysis plan.

Test methods for selected waste characterization parameters have been standardized by EPA. These EPA-approved methods are described in detail in EPA's "Test Methods for Evaluating Solid Waste" (SW-846). This document is a compilation of analytical methods that have been approved by EPA for use in the RCRA program. SW-846 methods for determining various parameters are accepted by EPA without further justification by the generator or facility owner/operator.

EPA continually updates SW-846 to provide additional or improved test methods. Sometimes, however, it may be appropriate to employ a special test method that has not been approved by EPA. If such a method is proposed for a particular analysis, approval must be received from EPA prior to its inclusion in the waste analysis plans.

40 CFR Part 261, Appendix III, Chemical Analysis Test Methods, is another useful source of methods. This appendix lists analytical procedures for determining if a waste contains a specific toxic element or compound. It contains three tables of information on analyzing for toxic waste constituents - Tables 1 and 2 list analytical methods for specific organic and inorganic constituents, respectively, and Table 3 lists ways to prepare samples and introduce them into a system for analysis.

40 CFR 270.30, "Conditions applicable to all permits," addresses quality assurance in paragraph (e), "Proper operation and maintenance." It states--

18<

> "Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures."

This quote is the extent of regulatory requirements for quality assurance and quality control. Further information, however, may be found in Section 10 of "Test Methods for Evaluating Solid Waste" (SW-846). An adequate quality control/quality assurance assurance program must address all of the technical aspects of such a program described in Section 10 of SW-846. Appendix B contains example waste analysis plans for various hazardous waste management scenarios. These examples should be reviewed to gain insight as to an appropriate level of detail for a quality assurance/quality control program for various levels of hazardous waste management facilities. As shown in the examples, quality assurance/quality control programs may be presented best as an appendix to a waste analysis plan.

4. CHECKLISTS FOR WRITING OR REVIEWING WASTE ANALYSIS PLANS

This section presents "checklists" of information needed in a waste analysis plan. These checklists are intended to help agency permit writers to review permit applications more expeditiously and uniformly. They are also useful to permit applicants as a convenient check to make sure the application contains the necessary information. The checklists address the items that are required in a "complete" plan as well as additional items which, if present, will make the plan more useful and assist the reviewer in evaluating the application. The checklists are designed to allow one to check off if an item is or is not properly addressed. By properly addressing the checklist items, an applicant can minimize the chances of submitting an incomplete application. For the convenience of the user, the checklist items not required by the regulations are footnoted.

Table 4-1, "Waste Analysis Plan Checklist- General Information," applies to all hazardous waste management facilities. The checklist can be used regardless of the specific hazardous waste management process(es) operated at the facility. It is divided into five major categories:

- Facility Description
- Identification of Wastes to be Managed
- Process Tolerance Limits
- Waste Parameters to Be Monitored
- Waste Sampling, Analysis, and Quality Assurance/ Quality Control (QA/QC) Procedures.

These five categories correspond to the example provided in Section 3.3, "Abbreviated Example Plan." Applicable RCRA regulations are cited within the checklist.

Table 4-2, "Waste Analysis Plan Checklist - Specific Hazardous Waste Management Process," presents additional checklist items specific to particular hazardous waste management processes. These checklists include information items that are required in addition to the general checklist information. They are based on 40 CFR 264, 265 (thermal, chemical, physical, and biological treatment), and 270 information requirements. Only those portions dealing with the specific process will be applicable to a given facility's waste analysis plan.

Table 4-3, "Optional Items to Consider When Preparing A Waste Analysis Plan," contains information that is not specifically required under RCRA. However, this information may contribute to a more complete waste analysis plan, making it more useful to operators on a day-to-day basis. Permit reviewers should use this table with discretion when reviewing waste analysis plans since the regulations do not require this material.

20<

TABLE 4-1. WASTE ANALYSIS PLAN CHECKLIST - GENERAL INFORMATION

I. FACILTIY DESCRIPTION[1]

a. Are all hazardous waste management processes identified? ___yes ___no

b. Is sufficient information provided for each process to confirm that the wastes can be properly managed at the facility? ___yes ___no

II. IDENTIFICATION OF WASTES TO BE MANAGED[1]

a. Is there a list of wastes or description of waste types to be permitted for each process? ___yes ___no

b. Are the properties of the wastes that are pertinent to the process provided? ___yes ___no
  - Physical properties, physical state, chemical properties
  - Ignitability, reactivity, and/or incompatability
  - RCRA number and basis for RCRA hazard designation
  - Documented waste data from a source other than one's waste analyses, e.g., data from a similar process

c. Does the owner/operator identify any waste characteristic limitations? ___yes ___no
  - Boundary conditions of waste properties
  - Restricted wastes

III. PROCESS TOLERANCE LIMITS[1]

a. Does the plan address any process tolerance limits (e.g., the minimum Btu/lb of waste or waste mixture that can be incinerated to 99.99%)? ___yes ___no

b. Is any process pretreatment specified in order to meet tolerance limits? ___yes ___no

IV. WASTE PARAMETERS TO BE MONITORED

40 CFR 264.13 (b)(1)

a. Does the plan include parameters that are measured to characterize the waste? ___yes ___no

b. Are rationales provided for the parameters? ___yes ___no

40 CFR 264.13 (a)(3) and (b)(4)

c. Does the owner/operator address recharacterizing the waste? ___yes ___no
  - Potential for wastes restricted from the facility being included by mistake
  - Process design limitations
  - Variability of waste composition
  - Chemical/physical instability of the waste
  - Prior history of the generator's performance and reliability

d. Are there procedures in place should recharacterization prove a waste is unacceptable by the facility? ___yes ___no

40 CFR 264.13 (b)(5)

e. [2]Are any wastes analyzed outside the facility? ___yes ___no
- Documentation of analytical procedures and representative sampling

40 CFR 264.13 (c)

f. [2]Does the plan include waste shipment screening procedures? ___yes ___no
- Procedures to review shipment's manifest
- Procedures to inspect shipment visually
- Frequency and % of shipment inspected, sampled, and/or analyzed annually
- Procedures when a shipment arrives that is unacceptable by the facility
- Key parameters for shipment analysis of each waste or waste type

40 CFR 264.13 (a)(3)(i)

g. Are there procedures should the owner/operator be notified or suspicious that the waste generation process or operation has changed? ___yes ___no
- Procedures to obtain information needed
- Sampling and analysis procedures
- Criteria to evaluate waste change information
- Procedures for handling wastes proven unacceptable by the facility

V. WASTE SAMPLING, ANALYSIS, and QA/QC PROCEDURES

40 CFR 264.13 (b)(3)

a. Does the plan include representative waste sampling procedures? ___yes ___no
- Sampling method number and reference
- Sampling device
- Description of any method not approved by EPA
- Statistically representative sampling technique (simple, stratified, or systematic random sampling; composite or grab sampling; subsampling)
- Practicality of statistically representative sampling (physical barriers, alternative methods) addressed
- Number of sampling sites
- Waste containment device when sampling
- Physical state(s)/layers of waste

22<

TABLE 4-1. (continued)

- Precision and accuracy of sampling procedures
- Rationale for sampling strategy selected

b. [2]Are any samples taken by nonfacility people? ___yes ___no
- Certification/documentation of representative sampling procedures

40 CFR 264.13 (b)(2)

c. Is waste analysis information provided? ___yes ___no
- SW-846 test method and number if EPA-approved
- Detailed description and reference of any method not EPA-approved

40 CFR 270.30 (e)

d. Does the plan include a QA/QC program for waste sampling and analysis? ___yes ___no
- Goals of program
- Intended use and quantity of data to be gathered
- Acknowledgement that QA/QC will be followed as described in specific test methods in SW-846.

e. Does the program include the performance evaluation of trained sampling and analysis personnel? ___yes ___no
- Frequency of evaluation and rationale
- Documentation of evaluation

f. Is there a sample chain of custody procedure? ___yes ___no
- Container labeling and seals
- Field logbook
- Receipt and logging of samples by lab personnel
- Chain of custody records
- Sample analysis request sheet
- Method of containment and preservation
- Confirmation sheet of sample delivery to lab

g. Does the internal or commercial lab document the lab aspects of chain of custody? ___yes ___no
- Numbering and documenting path of sample through labs
- Destiny of remaining sample after analysis
- Documentation and forwarding of test results to manager for filing

h. Is lab equipment inspected, maintained, and serviced periodically? ___yes ___no

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[1] Inclusion of this information is recommended 1) to make the application easier to review, and 2) to allow the plan to stand alone for use as an operating document. This information is not required in a waste analysis plan by regulation; chemical and physical analyses of the waste (40 CFR 270.14 (b)(2)) may be referenced from another Section of Part B.

[2] Applies primarily to offsite facilities.

TABLE 4-2. WASTE ANALYSIS PLAN CHECKLIST - SPECIFIC HAZARDOUS WASTE MANAGEMENT PROCESS

CONTAINERS

Does the waste analysis plan include procedures for the following where appropriate:

1. Determining compatibility of a waste to a container (if not determined when containers were first selected)? ___yes___no

2. Determining compatibility of a waste to other wastes stored nearby in containers, piles, open tanks, or surface impoundments? ___yes___no

3. Determining compatibility of a waste to wastes previously held in reused containers that were not decontaminated? ___yes___no

4. Analyzing ignitable/reactive containerized wastes? ___yes___no

5. Analyzing liquids that are collected in a storage area? ___yes___no

TANKS

Does the waste analysis plan include procedures for the following where appropriate:

1. Determining compatibility of a waste to a tank (if not determined when tank was first selected)? ___yes___no

TANKS (cont'd.)

2. Determining compatibility of a waste to any raw materials or other wastes potentially or previously held in the tank? ___yes___no

3. Analyzing ignitable/reactive wastes managed in tanks? ___yes___no

SURFACE IMPOUNDMENTS

Does the waste analysis plan include procedures for the following where appropriate:

1. Determining compatibility of a waste to the impoundment's materials of construction (if not determined when materials were first selected)? ___yes___no

2. Determining the compatibility of a waste to any raw materials or other wastes potentially held in the impoundment? ___yes___no

3. Procedures for analyzing ignitable/reactive wastes managed in impoundments? ___yes___no

WASTE PILES

Does the waste analysis plan include procedures for the following where appropriate:

1. Determining the compatibility of a waste to the pile's materials of construction (if not determined when materials were first selected)? ___yes___no

TABLE 4-2. (continued)

WASTE PILES (cont'd.)

2. Determining the compatibility of a waste to other wastes potentially held in the same pile, other piles, container, open tanks, or surface impoundments onsite? ___yes___no

3. Determining the compatibility of a waste to wastes previously held on the pile base if it was not decontaminated (unless it can be proven the wastes are the same)? ___yes___no

4. Analyzing ignitable/reactive wastes managed in waste piles? ___yes___no

5. a) Sampling and analyzing leachate collected beneath the pile, and b) managing the leachate if hazardous? ___yes___no

INCINERATION

Does the waste analysis plan include the following information:

1. Additional waste characteristic parameters required as a result of an EPA-approved trial burn:

- Heat value
- Viscosity (if applicable)
- Appendix VIII constituents
- POHCs[1] designated from Appendix VIII constituents? ___yes___no

INCINERATION (cont'd.)

2. Sampling and analysis procedures for item 1. parameters? ___yes___no

THERMAL TREATMENT

Does the waste analysis plan include the following information:

1. Additional waste characteristic parameters required:

- Heat value
- Halogen content and sulfur content
- Concentrations of mercury and lead, unless documented data show the elements aren't present? ___yes___no

2. Sampling and analysis procedures for these parameters? ___yes___no

PHYSICAL, CHEMICAL, AND BIOLOGICAL TREATMENT

Does the waste analysis plan include the following:

1. Any additional waste characteristic parameters required as a result of an EPA-approved trial test? ___yes___no

2. Sampling and analysis procedures for these specific parameters? ___yes___no

TABLE 4-2. (continued)

PHYSICAL, CHEMICAL, AND BIOLOGICAL TREATMENT (cont'd.)

3. Procedures to determine the compatibility of a waste to process structure (if not determined when structure was first selected)? ___yes___no

4. Procedures to determine the compatibility of a waste to any raw materials or other wastes potentially or previously held in the process structure? ___yes___no

5. Procedures for analyzing ignitable/reactive wastes managed in the process structure? ___yes___no

LAND TREATMENT

Does the waste analysis plan include the following:

1. Any additional waste characteristic parameters required as a result of an EPA-approved land treatment demonstration, e.g., Appendix VIII PHCs[2]? ___yes___no

2. Sampling and analysis procedures for Item 1. parameters? ___yes___no

3. Procedures to determine the compatibility of a waste to any raw materials or other wastes potentially applied in a given treatment zone? ___yes___no

4. Procedures for analyzing ignitable/reactive wastes to be treated? ___yes___no

LANDFILL

Does the waste analysis plan include procedures for the following where appropriate:

1. Inspecting containers for free liquids before disposal and for handling any unacceptable free liquids that may appear? ___yes___no

2. Inspecting containers for 90% volume by waste and for handling any containers of waste that are unacceptable by the facility that may appear? ___yes___no

3. Determining the compatibility of a waste to landfill liner(s) and leachate collection system materials (if not determined when materials were first selected)? ___yes___no

4. Determining the compatibility of a waste to any other wastes potentially disposed in the landfill? ___yes___no

5. Analyzing ignitable/reactive wastes to be disposed? ___yes___no

6. a) Sampling and analyzing leachate collected and b) managing the leachate if hazardous? ___yes___no

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[1] POHC - Principal Organic Hazardous Constituent.

[2] PHC - Principal Hazardous Constituent.

TABLE 4-3. OPTIONAL ITEMS TO CONSIDER WHEN PREPARING A WASTE ANALYSIS PLAN[1]

I. IDENTIFICATION OF WASTES TO BE MANAGED

An identification number for a waste that may indicate its generation source

Known health and environmental effects

Any analytical data sheets on waste

Any existing documentation on the waste's compatibility or incompatibility

Certification of validity of any waste data provided by a generator

II. WASTE PARAMETERS TO BE MONITORED

Screening procedures[2]

- Reference to reviewing shipment manifests for information such as--
  - Manifest document number
  - Generator's name, address, and EPA I.D. number
  - Each transporter's name and EPA I.D. number
  - The destination of each shipment, i.e., HWMF, address, and EPA I.D. number
  - An alternative HWMF, address, and EPA I.D. number
  - DOT shipping name and number
  - Quantity/volume of waste in shipment

II. WASTE PARAMETERS TO BE MONITORED (cont'd.)

  - Number and type of containers
  - Signed certification and date
- Visual inspection of shipment
  - Number and type of containers match manifest
  - Shipment labels/placards/marks, i.e., RCRA and DOT, match manifest description
  - Presence of free liquids and consistency with manifest description
  - Irregularities with shipment, e.g., leaks
  - Wastes restricted from the facility that are visibly present
  - Waste color's consistency with the characterization form's description
  - Consistency between the waste's visible physical state and the characterization form's description
- Acceptance/rejection procedures
  - Documentation of acceptance when results of waste inspection and analysis agree with waste characterization data

TABLE 4-3. (continued)

- Reanalysis procedures for a waste shipment when test results are inconsistent with characterization data
    - notifying generator of inconsistency
    - agreement to reject or reanalyze waste shipment (document)
    - analysis of an unused original sample's replicate or a new sample
    - notifying generator or waste acceptance or rejection
- Rejection procedures for an unacceptable waste
- Agreements with generator if a waste is unacceptable
- Temporary storage plans before unacceptable waste is shipped offsite for other management

III. WASTE SAMPLING, ANALYSIS, AND QA/QC PROCEDURES

Comments on sampling

- Protective gear required
- Sample container
- Weather constraints
- Storage instruction
- Sample life

Diagrams of sampling points

Detection limits of analytical method

Rationale for selecting a test method if more than one method is available

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[1] This information is not required by 40 CFR 264.13; however, it may contribute to a more complete and useful waste analysis plan.

[2] Used primarily by offsite hazardous waste management facilities.

REFERENCES

1. Permit Applicants' Guidance Manual for the General Facility Standards of 40 CFR 264. SW-968, U.S. Environmental Protection Agency, Washington, D.C. 1983. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

2. Hatayama, H. K., J. J. Chen, E. R. de Vera, R. D. Stephens, and D. L. Storm. A Method for Determining the Compatibility of Hazardous Wastes. EPA-600/2-80-076, U.S. Environmental Protection Agency, Cincinnati, Ohio, 1980. 149 pp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

3. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. SW-846, 2nd Edition, U.S. Environmental Protection Agency, Washington, D.C. 1982. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

4. Design and Development of a Hazardous Waste Reactivity Testing Protocol. EPA-600/52-84-057, U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, Ohio. 1984. Available from the National Technical Information Service (NTIS No. PB84-158807).

5. Permit Applicants' Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities. SW-84-004, U.S. Environmental Protection Agency, Washington, D.C. 1983. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

6. Guidance Manual for Hazardous Waste Incinerator Permits. SW-966, U.S. Environmental Protection Agency, Washington, D.C. 1983. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

29<

APPENDIX A

40 CFR 264.13 GENERAL WASTE ANALYSIS

(a)(1) Before an owner or operator treats, stores, or disposes of any hazardous waste, he must obtain a detailed chemical and physical analysis of a representative sample of the waste. At a minimum, this analysis must contain all the information which must be known to treat, store, or dispose of the waste in accordance with the requirements of this part or with the conditions of a permit issued under Part 270 and Part 124 of this chapter.

(2) The analysis may include data developed under Part 261 of this chapter, and existing published or documented data on the hazardous waste or on hazardous waste generated from similar processes.

(3) The analysis must be repeated as necessary to ensure that it is accurate and up to date. At a minimum, the analysis must be repeated:

(i) When the owner or operator is notified, or has reason to believe, that the process or operation generating the hazardous waste has changed; and

(ii) For off-site facilities, when the results of the inspection required in paragraph (a)(4) of this section indicate that the hazardous waste received at the facility does not match the waste designated on the accompanying manifest or shipping paper.

(4) The owner or operator of an offsite facility must inspect and, if necessary, analyze each hazardous waste movement received at the facility to determine whether it matches the identity of the waste specified on the accompanying manifest or shipping paper.

(b) The owner or operator must develop and follow a written waste analysis plan which describes the procedures which he will carry out to comply with paragraph (a) of this section. He will keep this plan at the facility. At a minimum, the plan must specify:

(1) The parameters for which each hazardous waste will be analyzed and the rationale for the selection of these parameters (i.e., how analysis for these parameters will provide sufficient information on the waste's properties to comply with paragraph (a) of this section);

(2) The test methods which will be used to test for these parameters;

(3) The sampling method which will be used to obtain a representative sample of the waste to be analyzed. A representative sample may be obtained using either:

(i) One of the sampling methods described in Appendix I of Part 261 of this chapter; or

(ii) An equivalent sampling method.

(4) The frequency with which the initial analysis of the waste will be reviewed or repeated to ensure that the analysis is accurate and up to date; and

(5) For off-site facilities, the waste analyses that hazardous waste generators have agreed to supply.

(6) Where applicable, the methods which will be used to meet the additional waste analysis requirements for specific waste management methods as specified in §264.17 and 264.341.

(c) For off-site facilities, the waste analysis plan required in paragraph (b) of this section must also specify the procedures which will be used to inspect and, if necessary, analyze each movement of hazardous waste received at the facility to ensure that it matches the identity of the waste designated on the accompanying manifest or shipping paper. At a minimum, the plan must describe:

(1) The procedures which will be used to determine the identity of each movement of waste managed at the facility; and

(2) The sampling method which will be used to obtain a representative sample of the waste to be identified, if the identification method includes sampling."

APPENDIX B

EXAMPLE WASTE ANALYSIS PLANS

The model waste analysis plans presented in this Appendix pertain to hazardous waste management procedures for hypothetical facilities. The purpose of including these examples in this manual is to demonstrate approaches to preparing complete waste analysis plans for each of the basic hazardous waste management scenarios.

The model plans included here address the following hazardous waste management practices:

Container storage
Tank storage
Surface impoundment
Waste pile
Land treatment
Incineration
Chemical treatment
Landfill.

Each case study has been kept as simple as possible in an effort to focus on the necessary elements of the waste analysis plan.

On July 20, 1984, EPA proposed "a standard RCRA permit application form for use by a select group of facilities whose only activity subject to RCRA permitting consists of storing in above-ground tanks or containers hazardous wastes that have been generated on-site." (49 FR 29524). This application form was developed because certain types of storage facilities "present regulatory control issues that are essentially identical." This proposed application form is scheduled to be finalized by mid-1985. Some storage facilities may not fit into this waste management classification or may be located in a state that would not use the form. For these reasons, along with the proposed status of the form, model waste analysis plans for container and tank storage facilities that are based on existing regulations are included in Appendix B.

The following tests are not addressed in the Appendix B model waste analysis plans:

- waste management compliance monitoring (e.g., groundwater monitoring, incinerator stack monitoring),
- waste management process operation monitoring (e.g., groundwater monitoring, incinerator stack monitoring),
- pre-permit process performance analyses (e.g., trial burns, land treatment demonstrations), and
- closure plan analyses.

32<

These tests are not a part of waste analysis plans. Such tests should be addressed in other portions of Part B applications.

These models are not intended to be inflexible formats for writing waste analysis plans; rather, they are examples furnished to provide guidance to both the permit applicant and the permit writer. The numerical values for physical properties and chemical analyses in this Appendix have been selected arbitrarily and do not necessarily reflect actual levels in the types of streams described. Where possible, however, the industry descriptions and stream compositions were based on information provided in the RCRA background information document, "Identification and Listing of Hazardous Waste" (EPA 1980)[1]. Comments regarding safety precautions for sampling were taken from Toxic and Hazardous Industrial Chemicals Safety Manual prepared by the International Information Institute (Japan 1976)[2].

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[1] U.S. Environmental Protection Agency. (Identification and Listing of Hazardous Waste Under RCRA, Subtitle C, Section 3001: Listing of Hazardous Waste (40 CFR 261.31 and 261.32). PB81-190035, National Technical Information Service, Springfield, Virginia, 1981.

[2] The International Technical Information Institute. Toxic and Hazardous Industrial Chemicals Safety Manual. The International Technical Information Institute, Japan, 1976.

MODEL WASTE ANALYSIS PLAN

CONTAINER STORAGE

1. Facility Description

The Aircraft Parts Manufacturing Company uses trichloroethylene (TCE) as a cold cleaning solvent to remove grease, oil, and dirt from its products before shipment. There are three principal manufacturing processes at the company's plant, each of which generates one waste stream of spent solvent degreaser consisting of trichloroethylene, oil, grease, and dirt. This spent solvent degreaser represents the only hazardous waste generated onsite. This waste is designated RCRA hazardous (F001) due to the toxicity of trichloroethylene. It is stored in 55-gallon drums on a sheltered cement slab near the loading dock until 45 to 50 drums have accumulated. The waste is shipped to a commercial solvent reclamation facility at approximately 6-month intervals.

The Aircraft Parts Manufacturing Company is requesting a RCRA permit to store spent trichloroethylene in drums at the designated area onsite described above. The storage area will be permitted to hold only the spent trichloroethylene.

2. Identification of the Spent Solvent

Table 1 lists the characteristics of each hazardous waste stream generated onsite that we consider pertinent to the proper operation of the storage facility. The three waste streams we manage range in composition from 80 to 95 percent trichloroethylene by volume, with the remainder being oil and grease and an immeasurable amount of dirt. The data listed reflect analysis results from three samples taken at 4-month intervals at each generation process area. The waste characterization was performed by an offsite commercial laboratory, Smith Labs. The Lab's analytical results are found in Appendix I. Quality assurance and quality control programs associated with this lab are described in Appendix II.

The following boundary conditions have been established for the spent solvent characteristics:

- ± 15 percent of the specific gravities listed in Table 1, and
- flash point less than 60° C.

Not meeting these conditions will alert us that the waste is not typical and may require special handling or analysis before shipment offsite. Any wastes that exceed the boundary conditions will be handled according to the procedures described in Section 4, "Parameters to be Monitored." Our experience with this waste has led us to establish these conditions, and we do not expect the waste to vary outside these boundaries. Supporting analytical data are available upon request.

TABLE 1. WASTE CHARACTERISTICS

	Stream[1,2,3]	Basis for Hazard Listing	Physical Properties[4]	Chemical Composition (or % by volume)
A	Spent Solvent Degreaser (TCE)	TCE (Toxic)	Specific gravity: 1.30 to 1.46 Flash point: 73 to 77 °C	TCE: 85 to 95% by volume Oil and grease: 5 to 15% by volume Dirt: negligible
B	Spent Solvent Degreaser (TCE)	TCE (Toxic)	Specific gravity: 1.26 to 1.41 Flash point: 77 to 81 °C	TCE: 80 to 90% by volume Oil and grease: 10 to 20% by volume Dirt: negligible
C	Spent Solvent Degreaser (TCE)	TCE (Toxic)	Specific gravity: 1.28 to 1.44 Flash point: 75 to 79 °C	TCE: 82 to 92% by volume Oil and grease: 8 to 18% by volume Dirt: negligible

[1] Process code for all streams is S01, container storage.

[2] "A", "B", and "C" refer to process areas.

[3] All streams are assigned RCRA number F001 (40 CFR 261.31).

[4] All streams are liquid with one layer. The specific gravity of pure TCE is 1.465, and the flash point is 32° C.

3. Drum Storage Tolerance Limits

The storage process is limited by the amount of space available for holding drums and the spill containment capacity of the area. The type of storage drum selected to hold the spent trichloroethylene is compatible with the waste and approved by the Department of Transportation (49 CFR 172.101). These drums are not affected by the concentration of trichloroethylene in the waste.

4. Parameters to be Monitored

The spent trichloroethylene must be capable of safe storage in 55-gallon drums for up to 6 months. We believe that the spent solvent degreaser we generate meets this criterion because 1) the storage drums were selected for their chemical compatibility to the waste and 2) our parts cleaning process is routine and produces wastes of relatively consistent composition.

We have reviewed existing information on the waste properties (including a search for ignitability/reactivity), noted what properties best indicate any change in a waste, and compared this information to our storage facility's design criteria. Since the only facility limitations are waste storage and spill containment capacity, the waste analysis parameters to be measured were selected to verify the nature of the waste.

Review of our operating records indicates that the characteristics of the spent solvent probably will change only in the proportion of oil and grease dissolved in the solvent. Only one hazardous (toxic) constituent, trichloroethylene, is generated onsite; therefore, it has been selected as a parameter to be determined. Specific gravity was selected as a parameter to provide an indication of the spent solvent's variation in contaminants.

Since no other hazardous wastes are stored onsite, no potential exists for hazardous waste incompatibilities. The drums are purchased new and uncontaminated; therefore, no potentially incompatible wastes have been held in these drums before the spent solvent is placed in them. When the filled drums are shipped offsite, they are not returned to us for reuse; however, we are credited by the reclaimer for empty drums.

We decided how often we felt it necessary to characterize the spent solvent with these tests by considering --

- the potential for other materials onsite being mistakenly placed in these drums,
- the variability of the spent solvent composition, and
- the likelihood of the spent solvent undergoing changes that alter its permitted characteristics.

Our trichloroethylene wastes seldom change since 1) only one type of hazardous waste is generated onsite, and 2) the generating process is routine. Therefore, we believe that annual characterization is sufficient to maintain our file of chemical information should a waste spill occur onsite. The characterization will be performed by Smith Labs. The offsite solvent reclamation facility that receives our waste takes samples and analyzes them for its own needs.

If characterization analyses ever indicate that the waste is either unacceptable by the reclaimer or incompatible with our wastes stored onsite, we will follow the procedures described in the following paragraphs.

Should one of our process area personnel ever notify us that the solvent degreasing process or its means of operation has changed, we will check to see if the spent trichloroethylene has changed in character. As much information about the change will be obtained as our personnel can provide. We will obtain an unscheduled sample (according to our sampling procedures) and submit it to Smith Labs for analysis. We will inform Smith personnel of any known property changes and they will analyze the waste according to the agreed analysis procedures. As per our standard agreement with Smith, should they detect any change of greater than 15 percent in specific gravity, a flash point below 60° C, or an unexpected constituent in the gas chromatogram, Smith Labs will notify us.

We will notify the commercial reclamation contractor of any change, so that the contractor can decide if the waste is still acceptable at his facility. If the waste is not acceptable, we will make every effort to find another reclaimer to receive the waste. In the interim, the waste will remain stored onsite.

The storage pad is already designed to comply with RCRA regulations for storing ignitable waste if the waste flash point ever becomes less than 60° C. Should any wastes be incompatible with the wastes currently in storage, we will contact our reclaimer and, if acceptable, load and ship the wastes to him in order to avoid common storage with the typical wastes.

5. Waste Sampling and Analysis

Sampling

We sample one drum from each process area since 1) we generate such small volumes of solvent, and 2) the solvent has a very low potential for varying in composition within the process area. The specific drums to be sampled will be selected using the simple random sampling method for containers as described in "Test Methods for Evaluating Solid Wastes" (SW-846), Section 1.4.1. Simple random sampling entails using the random numbers table to select drums to sample. [See Appendices C and D of this manual.] All containers are the same type of 55-gallon drum and are easily accessible for sampling through the bung. Since the waste is homogeneous, a representative sample can be obtained even though the sampler is limited to a single vertical area.

A glass Coliwasa device will be used to sample the spent solvent. Glass is inert to chlorinated organics so analysis should be free of interference. Samples will be stored in glass sample containers with teflon-lined Bakelite® caps. These materials will not react with chlorinated organics.

The storage facility is designed to prevent any run-on of precipitation. No direct precipitation should collect in our facility because it is sheltered from the weather. However, if any liquid is collected in the storage sump, it will be sampled by taking a Coliwasa grab sample and analyzed for the same parameters as the drummed waste. If the sump liquid is hazardous as defined in 40 CFR Part 261, it will be drummed, labeled, and stored along with the other trichloroethylene waste.

Our sampling personnel will take special precautions when sampling any wastes related to trichloroethylene because of its known toxicity. We reviewed the scientific literature and our previous work history to identify any needs for special handling procedures for the waste in order to protect our personnel and keep the samples representative.

A summary of our sampling procedures is provided below. The approach pertains to characterization as well as to unscheduled sampling of the spent trichloroethylene.

Containment Device	55-gallon drums
Sampling Technique	Simple random sampling Grab samples
Sampling Device	Coliwasa
Number of Drums Sampled	One drum from each stream
Comments	1. Wear goggles, rubber gloves, and apron. 2. Have area well-ventilated. 3. Get sample from midlevel of drum. 4. Place sample in glass bottle with teflon cap. 5. TOXIC WASTE.
References	Technique: SW-846[1], Section 1.4.1 Device: SW-846, Section 1.2.1.1

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[1] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

Quality assurance and quality control procedures for waste sampling are described in Appendix II.

Analysis

Table 2 identifies the test method to be employed to measure each waste parameter. All parameters and test methods apply to all three of the wastes streams due to their similarity. The test methods were chosen from the American Society for Testing and Materials (ASTM) compendium of test methods and EPA's "Test Methods for Evaluating Solid Waste" (SW-846). Quality assurance and quality control procedures for analyzing the waste are discussed in Appendix II.

TABLE 2. WASTE ANALYSIS PARAMETERS AND METHODS FOR STREAMS A, B, AND C OF SPENT SOLVENT DEGREASER (TCE)[1]

Parameters	Analytical Methods	Rationale for Parameters
Specific gravity	ASTM D891, Method A (Hydrometer)	Identification of spent TCE
Flash point	SW-846[2], Method 1010 (Pensky-Martens)	Identification of spent TCE
Halogenated volatile organics	SW-846, Method 8010 (Gas chromatography--measure retention time for TCE)	Identification of spent TCE

[1] These wastes are recharacterized annually.
[2] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

APPENDIX I

SMITH LABORATORIES
Date: January 21, 1983

Sample Number: Drums 01-1
18-1
30-1
Collected: January 18, 1983
Received: January 18, 1983

Client: Aircraft Parts Mfg. Co.
Address

Sample Drum Number	Process Area Stream	Parameter	Results	Test Method
01-1	A	Specific gravity	1.38	ASTM[1]
		Flash point	75.2° C	1010[2]
		%Trichloroethylene (by volume)	90%	8010[2]
18-1	B	Specific gravity	1.34	ASTM[1]
		Flash point	79.4° C	1010[2]
		%Trichloroethylene (by volume)	85%	8010[2]
30-1	C	Specific gravity	1.36	ASTM[1]
		Flash point	77.7° C	1010[2]
		%Trichloroethylene (by volume)	87%	8010[2]

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[1] ASTM American Society for Testing and Materials
[2] "Test Methods for Evaluating Solid Waste" SW-846 July 1982.

Signature of Certification: John Smith
John Smith, President

SMITH LABORATORIES
Date: May 15, 1983

Sample Number: Drums 03-1
16-1
28-1

Client: Aircraft Parts Mfg. Co.
Address

Collected: January 18, 1983
Received: January 18, 1983

Sample Drum Number	Process Area Stream	Parameter	Results	Test Method
03-1	A	Specific gravity	1.42	ASTM[1]
		Flash point	76.5° C	1010[2]
		%Trichloroethylene (by volume)	92%	8010[2]
16-1	B	Specific gravity	1.29	ASTM[1]
		Flash point	77.8° C	1010[2]
		%Trichloroethylene (by volume)	87%	8010[2]
28-1	C	Specific gravity	1.30	ASTM[1]
		Flash point	77.5° C	1010[2]
		%Trichloroethylene (by volume)	85%	8010[2]

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[1] ASTM American Society for Testing and Materials
[2] "Test Methods for Evaluating Solid Waste" SW-846 July 1982.

Signature of Certification: John Smith
John Smith, President

SMITH LABORATORIES
Date: September 19, 1983

Sample Number: Drums 05-1
14-1
25-1

Client: Aircraft Parts Mfg. Co.
Address

Collected: January 18, 1983
Received: January 18, 1983

Sample Drum Number	Process Area Stream	Parameter	Results	Test Method
05-1	A	Specific gravity	1.45	ASTM[1]
		Flash point	74.2° C	1010[2]
		%Trichloroethylene (by volume)	87%	8010[2]
14-1	B	Specific gravity	1.40	ASTM[1]
		Flash point	80.0° C	1010[2]
		%Trichloroethylene (by volume)	86%	8010[2]
25-1	C	Specific gravity	1.42	ASTM[1]
		Flash point	78.4° C	1010[2]
		%Trichloroethylene (by volume)	89%	8010[2]

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[1] ASTM American Society for Testing and Materials
[2] "Test Methods for Evaluating Solid Waste" SW-846 July 1982.

Signature of Certification: John Smith
John Smith, President

APPENDIX II

Quality Assurance/Quality Control Program

Program Goal

Our program's goal is to obtain accurate and precise data on waste characteristics and to maintain an up-to-date log of those data. The analytical data we obtain are available --

- should a spill occur onsite, or
- so we can notify our solvent reclamation contractor if a process or operation change occurs.

Since the only hazardous waste constituent we store onsite is trichloroethylene, our data need to center around their properties. We measure only three parameters in our waste, so the quantity of data we need is minimal.

Sampling Program

We sample our own waste. One person is the sampler. He has been properly trained to sample the waste using the equipment described in Section 5. A description of his training is found in our "Training Program" chapter of Part B. His sampling skills are evaluated semiannually by our environmental manager; we feel this is a sufficient frequency since characterization sampling routinely occurs annually.

Once a sample is taken, the Coliwasa is decontaminated as directed by the device's manufacturer. When samples are taken, our employee logs vital data in a field book, labels the containers (See Figure II-1), and hand carries them to a designated room for cool storage until Smith Labs picks the samples up (within 24 hours). The employee prepares a request for analysis (see Figure II-2), which accompanies the samples to Smith Labs to specify waste samples and analytical data needed.

Analysis Program

All analytical procedures required by our company have been specified in a contract with Smith Labs. Smith is a commercial laboratory with trained analysts who are retrained annually. They maintain a rigorous quality assurance/quality control program which is available for review by EPA upon request. All of the hazardous waste analyses they conduct are performed within 48 hours of receipt and comply with SW-846 quality assurance/quality control procedures for specific test methods.

Analytical data are documented, returned to us for evaluation by our environmental manager, and then filed.

Collector J. Johnson Sample No. 18-1

Place of Collection Process Area B

Date Sampled November 16, 1983 Time Sampled 3:06 p.m.

Field Information Sample taken at mid-level in drum number 18. Sample appeared typical of waste.

Figure II-1. Sample container label.

Source: "Test Methods for Evaluating Solid Waste" SW-846, July 1982.

Collector J. Johnson Date Sampled 11/16/83 Time 3:06p.m. hours

Affiliation of Sampler employee - Aircraft Parts Mfg. Co.

Address 500 (number) 7th St. (street) Plaineville (city) - - (state) 00000 (zip)

Telephone (000) 555-1212 Company Contact M. Snyder

LABORATORY SAMPLE NUMBER	COLLECTOR'S SAMPLE NO.	TYPE OF SAMPLE[1]	FIELD INFORMATION
APM	18-1	liquid	Process Area Stream B-1

Analysis Requested Specific gravity, Flash point (Pensky Martens), and halogenated volatile organics (in particular, trichloroethylene).

Special Handling and/or Storage Wear goggles, rubber gloves, and apron; have area well-ventilated. TOXIC.

PART II: LABORATORY SECTION[2]

Received by J. Sexton Title Lab Mgr. Smith Labs Date 11/17/83

Analysis Required Same as "analysis requested"

[1] Indicate whether sample is soil, sludge, etc.

[2] Use back of page for additional information relative to sample location.

Figure II-2. Sampling analysis request.

Source: "Test Methods for Evaluating Solid Waste" SW-846. July 1982.

MODEL WASTE ANALYSIS PLAN

TANK STORAGE

1. Facility Description

The Solid Fuel Company formulates nitrocellulose-based propellants. We generate wastewaters originating from --

- cleaning of blending, packaging, and handling equipment and storage facilities;
- wet milling of propellant castings;
- air pollution wet scrubber control devices; and
- loading, assembling, and packaging of ordnance.

These wastewaters are physically treated onsite in settling pits where they produce a single-layer sludge which is a RCRA reactive hazardous waste due to its nitrocellulose content.[1]

The Solid Fuel Company requests a RCRA permit to store the wastewater treatment sludges in two open concrete tanks onsite. The tanks were designed specifically to contain the nitrocellulose-based sludge. We would accumulate the sludge until the tanks reach capacity and then transport it to an offsite hazardous waste management facility. The storage promotes sludge drying and is cost-effective. The tanks must be managed in the following ways to assure safe storage: 1) they will not be used for any waste that is incompatible with the sludge, 2) the sludge moisture content will not be allowed to fall below 70 percent, and 3) the tank will be protected from any sources that might initiate reaction.

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[1] 40 CFR 261.32 lists this waste as "K044 - wastewater treatment sludges from the manufacturing and processing of explosives." This waste category can be reactive due to one or more explosives industry products, nitrocellulose in this case.

2. Identification of Sludge

Table 1 contains the sludge characteristics that need to be controlled within specified limits if we are to operate the tank in compliance with anticipated permit conditions. The sludge entering the tank is a flowable liquid with approximately 5 percent solids. The water content of the sludge is reduced by the time the tank is emptied, but the sludge (approximately 25 percent solids) still remains flowable.

The sludge characterization yielding the data in Table 1 was performed by the analysts on our wastewater treatment plant staff. Our staff sampled and analyzed the two sludge streams four times over the past 2 years of our RCRA interim status operation. Sampling and analysis procedures followed those described in this plan. Quality assurance and quality control procedures used to characterize the sludge are described in the appendix of this waste analysis plan.

Boundary conditions have been established to alert us that the sludge generating process is not operating normally. The sludge entering the storage tank must always have a water content greater than 90 percent. The sludge, during its storage and upon leaving the tank, should never contain less than 70 percent water. Sludge pH should not be below 6.0. The water contents are maintained to decrease the potential for reaction due to drying. Too acidic a pH may also trigger sludge reaction. These boundary conditions were established based on our experience with the sludge and its potential for reacting.

TABLE 1. SLUDGE CHARACTERISTICS

Stream[1]	Chemical Composition
1. Sludge entering tank	Nitrocellulose: not more than 5% by volume Water: at least 95% by volume Other constituents: negligible pH: 8.0 to 10.0
2. Sludge leaving tank	Nitrocellulose: not more than 25% by volume Water: at least 75% by volume Other constituents: negligible pH: 8.0 to 10.0

---

[1] RCRA number: K044 (40 CFR 264.32).
Process code is S02, tank storage.

3. Tank Storage Process Tolerance Limits

In addition to the sludge boundary conditions described previously, the tank storage process is limited by the volume of sludge the tanks can hold safely. (Tank design information is in another chapter of this Part B application.) The tank should also not be allowed to receive wastes that may be incompatible with the sludge due to the potential for reaction. The tanked sludges must never be exposed to any sources of reaction because they may contain concentrations of reactive nitrocellulose that could be triggered.

These tolerance limits represent those qualitative and quantitative waste characteristics that the tank structure can manage within the RCRA permit conditions.

4. Waste Parameters to be Monitored

The sludge must be safely stored in an open tank for up to 6 months to dry without reacting. It can be managed for this period because 1) the tanks were designed specifically to store the reactive sludge, and 2) our years of operating data, which cover a broad range of production rates, indicate that the sludge fed to the tanks remains relatively consistent in composition. Also, variations in sludge composition are not sufficient to offer a serious threat of unexpected constituents.

To select the proper parameters to monitor storage performance, we 1) reviewed existing information on the sludge properties (including its reactivity), 2) noted what properties best indicate change in a waste, and 3) compared this information to the tank design criteria so we can assure compliance with RCRA permit conditions. These steps included identifying the tank design and operating limitations described in Section 3.

The wastewater treatment sludge generated by nitrocellulose production contains nitrocellulose and water. The sludge characteristics are expected to change only in the ratio of solids-to-water and perhaps pH. Parameters were chosen based primarily on the most significant sludge property-reactivity (or explosivity). The sludge pH, percent moisture, and, in turn, explosivity are measured to provide a sufficient indication of any important variation in sludge character.

When the tanks are emptied for offsite transport of the sludge, they are not decontaminated because they are being refilled with the same type of sludge that the tanks previously held. Therefore, no potential waste incompatibilities can occur and there is no need to monitor waste characteristics for incompatibilities. The transport vehicles are decontaminated by their owners before receiving the sludge, and they are constructed of materials that are compatible with the sludge to eliminate the potential for reactions.

Our in-house wastewater treatment plant staff will recharacterize the sludge semiannually as a load is prepared for offsite shipment. We prefer semiannual recharacterizations, because --

1) our years of operating experience indicate that the sludge's primary constituent, nitrocellulose, remains consistent; only its concentration relative to the moisture content and pH may vary in the sludge within a safe range (operating data available upon request);

2) the offsite hazardous waste management facility that accepts the sludge also analyzes it for their own purposes; and

3) the sludge samples are most representative when taken during tank drainage.

The wet sludge is the only waste pumped to the two tanks, and we have made every design effort to ensure that no unpermitted wastes enter the tanks. The wet sludge is pumped to the tank via a pipe isolated from other wastes. The storage tanks are located in an area protected from sources that might initiate reaction (see 40 CFR 264.190 to 264.199). Other chapters of this Part B application describe further how protection is accomplished.

Should the nitrocellulose process or its means of operation ever change, we will determine if the sludge characteristics have changed. First, we will obtain as much information about the process or operation change as our personnel can provide, and we will take an unscheduled sample of the most recent sludge placed in the tanks and analyze it according to EPA-approved procedures. Any nonroutine parameters for constituents that we suspect are present will also be measured. If we detect a change in the time required for the sample to react, we will make every effort to identify the source of the change in reactivity.

Our offsite hazardous waste management facility contractor will be notified of any change in order to determine if the waste is still acceptable at his or her facility. If the waste is not acceptable, we will make every effort to find another facility to receive it. In the interim, the sludge will remain stored onsite in a special holding tank.

5. Waste Sampling and Analysis

Sampling

The wastewater treatment sludge is sampled semiannually at two locations: 1) the inlet pipe directly at the storage tanks, and 2) the effluent pipe that drains the tanks. These sampling points were chosen because limited access to areas within the tanks limits the sample representativeness. The inlet pipe sludge is grab sampled during normal operations. The effluent is sampled as a tank is emptied for offsite shipment. It typically takes 1 hour to drain each tank, so we grab sample the initial effluent from the tank outlet pipe and continue to sample the effluent at 30-minute intervals. Each sample is containerized separately for analysis, giving us data on one sludge sample before it enters the tank and on effluent samples from three depths in the tank as it is drained. We do not composite these samples because the true reactivity of the sludge may be diluted.

We sample the flowing sludge with a dipper made of a glass beaker and fiberglass pole, both of which are not reactive to the sludge (SW-846, 1.2.1.3). The samples are stored in nonreactive glass containers.

Sampling for semiannual sludge recharacterizations and any unscheduled sampling follows the procedures described above.

We reviewed the scientific literature and our previous work history to identify any needs for special sludge handling procedures during sampling. This enables us to be certain that our employees are protected and our samples remain representative during storage.

The following information summarizes the previously described sampling procedures:

Containment Device	Lines leading to and exiting tank
Sampling Technique	Grab samples
Sampling Device	Dipper
Number of Samples Taken	Stream 1. - one Stream 2. - three, at beginning, midway, and end of tank drainage
Comments	1. Wear rubber gloves, face shield, and self-contained breathing apparatus. 2. Make sure ventilation is adequate. 3. Place sample in linear polyethylene container. 4. Do not let sample dry out. 5. Protect sample from excessive heat and direct sunlight. 6. Potentially REACTIVE.
References	Technique: SW-846[1], Section 1.4.2 Device: SW-846, Section 1.2.1.3

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[1] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

Quality assurance and quality control procedures for waste sampling are described in the appendix.

Analysis

The wastewater treatment sludge has been characterized to confirm its compliance with anticipated permit conditions. Section 4 describes how we selected the waste characterization parameters. Table 2 identifies the test method selected for each parameter and the rationale for selecting the parameter. All analytical methods listed in Table 2 are from EPA's "Test Methods for Evaluating Solid Waste" (SW-846) or the American Society for Testing and Materials (ASTM) compendium of test methods. Quality assurance and quality control procedures for waste analysis are discussed in the appendix.

TABLE 2. WASTE CHARACTERIZATION/RECHARACTERIZATION FOR WASTEWATER TREATMENT PLANT SLUDGE[1,2]

Parameters	Analytical Method	Rationale for Parameter Selection
Reactivity	U.S. Gap Test or U.S. Internal Ignition Test[3]	Assure storage safety
% Water	ASTM D95 - Distillation, or ASTM D1796 - Centrifuge	Value used to assess reactivity
pH	pH Meter Method 9040 (SW-846[4])	Verification of waste

---

[1] Applicable to both sludge streams (1 and 2).

[2] Semiannual recharacterization is planned.

[3] [Author's note: These explosivity tests are currently under development by the Bureau of Mines for EPA.]

[4] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

APPENDIX

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Program Goal

Our program's goal is to obtain accurate and precise sludge characteristics data resulting from sampling and analysis and to maintain up-to-date documentation of those data. The analytical results we obtain are available --

- to identify any anomalies that could lead to the sludge reacting or exploding,
- should a spill occur onsite, and
- so we can notify our offsite hazardous waste management facility contractor if a process or operation change is reflected in the sludge characteristics.

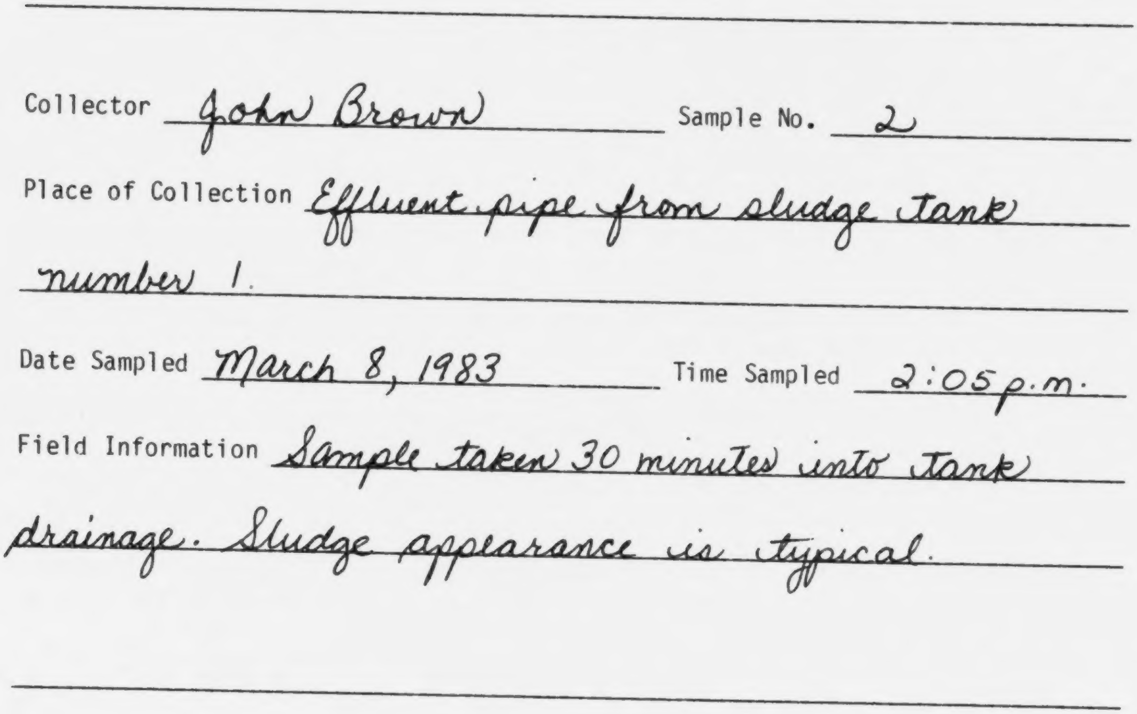
The amount of data we need to attain our goal is minimal. We have no onsite disposal; our offsite hazardous waste management facility analyzes the sludge themselves, and reactivity is the only potential threat the sludge poses. Therefore, determining sludge reactivity constitutes our primary reason for analysis.

Sampling Program

The sludge is sampled by two people on our wastewater treatment plant staff. They have been properly trained to use the sampling and analytical equipment described in Section 5, and their training program is described in another chapter of this application.

Employee sampling skills are observed annually by our environmental manager during the removal of sludge from tanks. We feel this frequency is sufficient since sampling with a dipper is simple and characterization sampling routinely occurs semiannually. Once a sample is taken, the dipper is decontaminated.

When samples are taken, our employee logs vital data in a field book, labels the containers (see Figure A-1), and hand carries the samples to the treatment plant laboratory where he or she begins analyzing them within 24 hours. Until analysis begins, the samples are stored in a designated area free from any sources of reaction.



Collector John Brown Sample No. 2

Place of Collection Effluent pipe from sludge tank number 1.

Date Sampled March 8, 1983 Time Sampled 2:05 p.m.

Field Information Sample taken 30 minutes into tank drainage. Sludge appearance is typical.

Figure A-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

Analysis Program

The two trained analysts are monitored by the environmental manager during sludge analysis. The tests for measuring moisture, water, and pH follow quality assurance/quality control procedures outlined in the methods descriptions. The analytical data generated are documented and kept on file in our environmental manager's office.

The lab equipment is inspected and serviced semiannually and as required on a nonroutine basis. Any leftover sample is returned to the storage tank.

MODEL WASTE ANALYSIS PLAN

SURFACE IMPOUNDMENT

1. Facility Description

The Jones Company manufactures automobile parts. One area of our manufacturing involves electroplating. Our primary electroplating process is segregated cadmium, which uses the metals cadmium and chromium. The spent plating/coating solution and rinse water generated by this process are sent to our wastewater treatment plant, where chromium and cadmium are precipitated out of solution as a sludge. Cyanide is destroyed to a negligible complexed concentration. This sludge category is designated RCRA toxic due to its potential to contain cadmium, chromium, and complexed cyanide.

The wastewater treatment sludge is transferred to the onsite surface impoundment for storage and some dewatering. Any wastewater that separates from the sludges is decanted and piped to the wastewater treatment plant. The impoundment usually reaches sludge containment capacity after 4 months of normal operation. As the impoundment approaches capacity, the sludge is removed and transported to an offsite hazardous waste management facility.

The surface impoundment was designed specifically to store and partially dewater the toxic wastewater treatment sludges from the electroplating process. It is equipped with a butyl rubber liner that was selected because it is compatible with the electroplating sludges. All other materials of construction of the impoundment were also selected to be compatible with the sludge. Another chapter of this Part B application provides a detailed description of the impoundment design.

The Jones Company is requesting a RCRA surface impoundment storage permit for wastewater treatment sludges generated by the electroplating process. The impoundment would be permitted to hold only these sludges.

2. Identification of Impounded Sludge

Table 1 lists the pertinent characteristics of the sludge to be impounded onsite. The data in Table 1 are based on three sets of samples collected and analyzed over the past year. Sludge characterizations were performed by the analysts on our wastewater treatment plant staff and by ABC Labs. Analytical results from ABC Labs are found in Appendix I. These data are consistent with the background information document (BID) data published for this industrial waste stream (F006). The quality assurance and quality control procedures used to characterize the sludge are described in Appendix II of this waste analysis plan.

Based on sludge analysis data collected in the past 5 years, we plan to use the following sludge characteristics as boundary conditions:

- free and complexed cyanide < 100 ppm
- cadmium < 25,000 ppm
- total chromium < 67,000 ppm
- pH 5.5 to 11
- total organic carbon <0.5%

(Supporting sludge data are available upon request.) Setting these boundary conditions helps alert us if a disturbance in the waste generating process and, in turn, waste characteristic changes have occurred. Meeting these conditions will help maintain the integrity of the surface impoundment structure.

TABLE 1. CHARACTERISTICS OF ELECTROPLATING WASTEWATER TREATMENT PLANT SLUDGE

Basis for Hazard Classification[1]	Physical State	Process Code	Chemical Composition[2]
Cadmium, hexavalent chromium, nickel[3] complexed cyanide, (reactive, toxic)	Sludge, single-layer	S04[4]	Total and Amenable Cyanide: Negligible Cadmium: 17,000 to 22,000 ppm Total Chromium: 50,000 to 62,000 ppm Water: 70 to 80% by weight pH: 7.0 to 9.5 Total Organic Carbon: Negligible

---

[1] This sludge is assigned the RCRA Number F006 (40 CFR 261.31).
[2] Refers to characteristics of the sludge as it leaves the impoundment.
[3] Nickel is not used in this electroplating process.
[4] Refers to surface impoundment storage.

3. Surface Impoundment Tolerance Limits

The surface impoundment has the following limitations:

- the volume of sludge in the impoundment must not exceed the design capacity in order to prevent overflow and contamination of adjoining areas,
- the impoundment should not receive any wastes that are incompatible with its butyl rubber liner, e.g., organics, so that it remains impermeable to the heavy metals; thus the total organic carbon in the wastes must be negligible, and
- the impoundment should not receive any wastes that are incompatible with the metallic sludge, reacting to damage the liner or emit dangerous gases; this includes free and complexed cyanide that must remain negligible in the waste.

These qualitative tolerance limits were established to assure that the surface impoundment safely stores the sludge without threatening environmental contamination.

4. Waste Parameters to be Monitored

To select waste parameters, we 1) reviewed existing information on the sludge properties such as 40 CFR 261, Appendix VII, and the BID on RCRA waste F006, 2) noted what properties best indicate any change in a waste, and 3) compared this information to our storage facility's design criteria so that we can prevent any noncompliance with our RCRA permit conditions. These steps included identifying the impoundment design and operation limitations described in Section 3.

The sludge characteristics are only expected to change in the cadmium and chromium concentrations, pH, and the percent volume of water; therefore, these parameters will be monitored. The construction materials in the surface impoundment are not sensitive to the concentration of the metals, and the pressure on the liner is limited by the volume of impounded waste that is controlled by decanting. Although these characteristics are not a common threat to the structural integrity of the impoundment, they will be monitored so that information is available in case the liner is ever damaged. We monitor sludge pH because unusual values may indicate threatening sludge anomalies. The sludge typically contains a negligible amount of complexed cyanide with no free cyanide, but if our wastewater treatment plant were upset, the potential may exist for cyanide to enter the impoundment. Therefore, free and complex cyanides are monitored. No organics enter the electroplating wastewater; however, total organic carbon will be monitored to assure no liner damaging organics are present.

Thus, the keys to preventing any sludge reactions are to make sure that 1) the cyanide levels are low, 2) organics do not enter the wastewater, and 3) the sludge is in its customary form. The fact that the sludge is transported to the impoundment through an isolated pipe precludes contamination from other process wastes.

The surface impoundment is not decontaminated after it is emptied because it will be refilled with the same type of sludge. Therefore, no incompatibilities should exist, and tests for incompatibilities are not conducted routinely. The transport vehicles are decontaminated by their owners before receiving the sludge, and they are constructed of materials compatible to the sludge, thus eliminating the potential for reactions.

We decided how often it was necessary to characterize our waste with these tests by considering --

- the potential for other materials on our site to be placed in the impoundment by mistake,
- the variability of our sludge's composition, and
- the instability of the waste.

We chose to have our in-house wastewater treatment plant staff and ABC Labs recharacterize the sludge annually. We prefer annual recharacterizations, because --

1) our years of operating data (available upon request) indicate the sludge's hazardous constituents, chromium, cadmium, and a negligible amount of complexed cyanide, are consistently present; only the concentrations of chromium and cadmium and the volume of water may vary in the sludge;

2) variations in heavy metal concentrations do not affect the impoundment's performance;

3) the offsite hazardous waste management facility that accepts the sludge analyzes it for their own purposes; and

4) there is a low probability of an unusual pH, or of a high concentration of free and/or complexed cyanide, or of organics present in the sludge.

If we are ever notified by one of our process area personnel that the electroplating or wastewater treatment processes or operations have changed, we check to see if the sludge characteristics have changed. We obtain as much information about the change as our personnel can provide and then take an unscheduled sample (according to our sampling procedures) from the wastewater treatment plant.

The analysis procedures include forwarding a sample to a commercial lab, ABC Labs, whom we have contracted to perform atomic absorption analyses for chromium and cadmium in the sludge. We will inform ABC Labs of any known sludge changes, and they will analyze a sample. ABC Labs will make every effort to characterize the sludge should they detect a significant change in cadmium or chromium concentration.

Our personnel will analyze sludge for free and complexed cyanide and they will proceed to characterize the sludge more completely if a significant increase in cyanide is detected. If the process change requires that we analyze for any nonroutine parameters, sludge samples will be analyzed either in-house or sent to ABC Labs.

We will notify our offsite hazardous waste management facility if any changes occur, so the owner/operator can decide if the sludge is still acceptable at the facility. If the waste is not acceptable, we will make every effort to find another facility to receive the sludge. In the interim, the sludge will remain stored onsite in transport tankers.

5. Waste Sampling and Analysis

Sampling

The sampling procedures were developed by first identifying the sludge physical/chemical properties and means of containment, i.e., surface impoundment. We selected an appropriate sampling device and sample container after reviewing "Test Methods for Evaluating Solid Wastes" (SW-846). Since the equipment selected is listed for material of the same physical form as the sludge, we believe that the equipment is suitable. We reviewed the scientific literature and our previous work history to identify any needs for special sludge handling procedures. This helps us to be certain that our employees are protected and our samples remain representative during storage.

It is practically impossible to sample all areas within the surface impoundment. Since accessible areas are primarily around the periphery of the impoundment, our samples are somewhat limited in their representativeness of the entire impoundment.

We randomly sample impoundment areas within reach. The sample areas selected are based on a three-dimensional grid. We divide the accessible areas into imaginary, sequentially numbered cells based on length, width, and depth of the sludge and then use the random numbers table to select the numbered cells to sample [See Appendix C of this manual]. A grab sample is taken from one randomly chosen cell at each depth level. One sample per depth level should be sufficient since there is little likelihood of damaging levels of cyanide being present in the sludge.

Weighted glass bottles are used for sampling sludge because 1) the bottles help isolate samples taken at different depths (SW-846, 1.2.1.2), and 2) we have found in previous efforts that the water content of the sludge is sufficient for it to flow into the bottle. The samples remain stored in these same weighted bottles until analyses are performed.

The waste characterization, recharacterizations, and any unscheduled sampling will follow the sampling procedures described in this section.

The following information summarizes the sampling procedures described above:

Containment	Surface impoundment
Sampling Technique	Limited simple random sampling Grab sample
Sampling Device	Weighted bottle
Number of Samples Taken	Grab one sample per depth level
Comments	1. Wear goggles, rubber gloves, protective clothing, respirator, and face mask. 2. Store sample away from acids and standing water. 3. TOXIC WASTE.
References	Technique: SW-846,[1] Section 1.1.3.1 Device: SW-846, Section 1.2.1.2

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[1] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

Quality assurance and quality control procedures for waste sampling are described in Appendix II.

Analysis

The wastewater treatment sludge has been analytically characterized with respect to its manageability onsite. Table 2 lists the test method selected for each parameter and the rationale for choosing each parameter. All analytical methods in Table 2 are EPA-approved. Quality assurance and quality control procedures for waste analysis are discussed in Appendix II. Our wastewater treatment plant staff and ABC Labs will perform these waste analyses.

TABLE 2. WASTE CHARACTERIZATION/RECHARACTERIZATION FOR ELECTROPLATING WASTEWATER TREATMENT PLANT SLUDGE[1]

Parameters	Analytical Method	Rationale for Parameter Selection	Detection Limit (μg/L)
Cadmium	AA Direct Aspiration, Methods 3050/7130 (SW-846[2])	Verification of waste	5
Total chromium	AA Direct Aspiration, Methods 3050/7190 (SW-846)	Verification of waste	50
Cyanide	Total and Amendable Cyanide, Method 9010 (SW-846)	Identify potential reactivity	-
pH	pH Meter, Method 9040 (SW-846)	Identify potential corrosivity	-
Total organic carbon	Combustion - Infrared Method, Method 505 (APHA[3])	Identify liner damaging organics	1,000

[1] Annual recharacterization is planned.

[2] SW-846 "Test Methods for Evaluating Solid Waste," July 1982.

[3] APHA American Public Health Association Standard Methods for the Examination of Water and Wastewater 15th edition, 1980.

APPENDIX I

ABC LABORATORIES

Date: May 10, 1983

Client: The Jones Company

Sample Number: 3-1
Collected: May 9, 1983
Received: May 10, 1983

Process Area Stream	Parameter	Results	Test Methods[1]
Electroplating Wastewater Treatment Plant Sludge	Total chromium	62,000 ppm	3050/7190
	Cadmium	22,000 ppm	3050/7130

---

[1] "Test Methods for Evaluating Solid Waste," SW-846, July 1982. (Atomic Absorption Methods)

Signature of Certification: I. Johnson

I. Johnson, Office Branch Manager

APPENDIX I

ABC LABORATORIES

Date: July 13, 1983

Client: The Jones Company

Sample Number: 13-1
Collected: July 12, 1983
Received: July 14, 1983

Process Area Stream	Parameter	Results	Test Methods[1]
Electroplating Wastewater Treatment Plant Sludge	Total chromium	57,500 ppm	3050/7190
	Cadmium	18,200 ppm	3050/7130

---

[1] "Test Methods for Evaluating Solid Waste," SW-846, July 1982. (Atomic Absorption Methods)

Signature of Certification: I. Johnson

I. Johnson, Office Branch Manager

APPENDIX I

ABC LABORATORIES

Date: October 1, 1983

Sample Number: 23-1
Collected: September 30, 1983
Received: October 1, 1983

Process Area Stream	Parameter	Results	Test Methods[1]
Electroplating Wastewater Treatment Plant Sludge	Total chromium	50,000 ppm	3050/7190
	Cadmium	17,000 ppm	3050/7130

---

[1] "Test Methods for Evaluating Solid Waste," SW-846, July 1982. (Atomic Absorption Methods)

Signature of Certification: I. Johnson

I. Johnson, Office Branch Manager

APPENDIX II

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Program Goal

Our program's goal is to acquire accurate and precise sludge information that could affect our impoundment performance and to maintain an up-to-date documentation of that information. The analytical data we obtain are available--

- to prevent any damage to our impoundment structure by the sludge,
- to prevent our sludge from reacting with the impoundment structure or any unexpected contents,
- should a spill occur onsite, and
- so we can notify our offsite hazardous waste management facility contractor if a process or operation change is reflected in the sludge characteristics.

The amount of data we need to obtain our goal is minimal. We have no onsite disposal, and our offsite hazardous waste management facility also analyzes the sludge. Therefore, we analyze the sludge for just five parameters to assure that it meets those characteristics stated in the RCRA permit.

Sampling Program

Two people on our wastewater treatment plant staff serve as sludge samplers. They have been properly trained to use the sampling equipment as described in our Part B application's "Training Program." Their sampling skills are observed annually by our environmental manager during the sampling sessions; we feel this is a sufficient frequency since sampling routinely occurs annually.

The weighted bottles used to sample sludge are decontaminated before reuse. When samples are taken, the employee logs vital data in a field book, labels the containers (see Figure II-1), and prepares a request for analysis for those samples sent to ABC Labs (see Figure II-2). The employee drives the samples back to the laboratory, properly stores the ABC Labs samples for pickup (within 48 hours), and then proceeds to our lab to analyze a sample for cyanide within 24 hours.

Collector K. White Sample No. 15-1

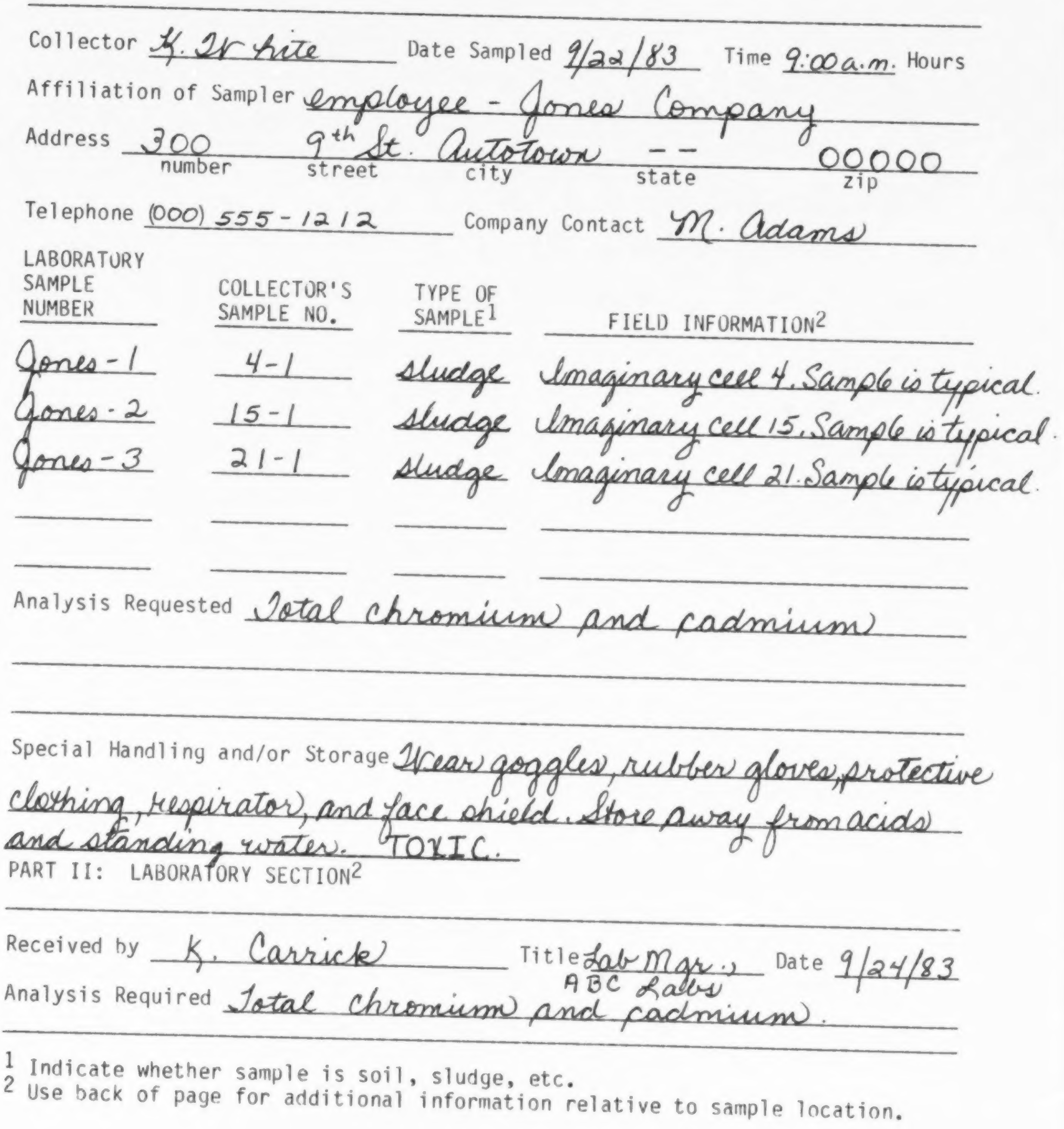
Place of Collection Surface impoundment imaginary cell number 15.

Date Sampled September 22, 1983 Time Sampled 9:00 a.m.

Field Information Sample appears typical

Figure II-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.



Collector K. White Date Sampled 9/22/83 Time 9:00 a.m. Hours

Affiliation of Sampler employee - Jones Company

Address 300 (number) 9th St. (street) Autotown (city) -- (state) 00000 (zip)

Telephone (000) 555-1212 Company Contact M. Adams

LABORATORY SAMPLE NUMBER	COLLECTOR'S SAMPLE NO.	TYPE OF SAMPLE[1]	FIELD INFORMATION[2]
Jones-1	4-1	sludge	Imaginary cell 4. Sample is typical.
Jones-2	15-1	sludge	Imaginary cell 15. Sample is typical.
Jones-3	21-1	sludge	Imaginary cell 21. Sample is typical.

Analysis Requested Total chromium and cadmium

Special Handling and/or Storage Wear goggles, rubber gloves, protective clothing, respirator, and face shield. Store away from acids and standing water. TOXIC.

PART II: LABORATORY SECTION[2]

Received by K. Carrick Title Lab Mgr., ABC Labs Date 9/24/83

Analysis Required Total chromium and cadmium.

[1] Indicate whether sample is soil, sludge, etc.

[2] Use back of page for additional information relative to sample location.

Figure II-2. Sampling analysis request.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

Analysis Program

Our sampling personnel are also trained as analysts. Their training program is described later in this application. The analysts are monitored by the environmental manager during sludge analysis. The test for measuring cyanide follows quality assurance/quality control procedures outlined in the SW-846 method description. The analytical data we generate are documented and kept on file in our environmental manager's office. The lab equipment used is inspected and serviced semiannually and as needed on a nonroutine basis. Any leftover sample from our analysis is returned to the surface impoundment.

All atomic absorption analysis procedures that our company requires have been specified in our contract with ABC Labs. ABC is a commercial laboratory with trained analysts who are retrained annually. They maintain a rigorous quality assurance/quality control program that is available for review by EPA upon request. All of their hazardous waste analyses are conducted for The Jones Company within 72 hours and comply with SW-846 quality assurance/quality control procedures for specific test methods. Analytical data are documented and returned to us for evaluation by our environmental manager and then filed.

MODEL WASTE ANALYSIS PLAN

WASTE PILE

1. Facility Description

The Color Company manufactures four inorganic chrome pigments: chrome yellow and orange, molybdate orange, and zinc yellow. These pigments are produced in simultaneous processes, and the resulting wastewaters are routed to the company's treatment plant. The sludge from the treatment plant contains hexavalent chromium and lead that cause it to be classified as a RCRA hazardous waste.

A vacuum filtration unit removes approximately 30 percent of the water from the sludge. The filter cake from this device is stored onsite in two sheltered waste piles that are filled sequentially. The filter cake dries for several months in the piles until enough is accumulated for transportation to an offsite hazardous waste management facility to be economical.

The waste piles are constructed with leachate collection systems and polyvinyl chloride (PVC) membrane liners. They were designed specifically to hold the wet filter cake produced by vacuum filtration of the wastewater treatment pigment sludges. All materials of construction were selected in keeping with their compatibility with the filter cake. Another chapter of this Part B application provides a detailed description of the waste pile design.

The Color Company is requesting a RCRA permit to store the pigment filter sludge cake in the waste piles. The waste piles would be permitted to hold only the filter cake.

2. Identification of Wastes Piled

Listed in Table 1 are the filter cake characteristics that are important in operating the waste piles in compliance with RCRA permit conditions. This characterization was performed by the analysts on our wastewater treatment plant staff and by XYZ Labs. (An example XYZ lab report is found in Appendix I.) The characteristics in Table 1 reflect the analysis results from eight samples of the filter cake taken at 6 to 8 week intervals over a period of 1 year. These results are supported by operating data collected over the past 10 years and by data presented in EPA's background information document (BID) on these waste streams (K002, K003, and K004). Quality assurance and quality control procedures used to characterize the filter cake are described in Appendix II of this waste analysis plan.

The filter cake must meet the following boundary conditions:

• total chromium	< 350 ppm	• pH	9.2 to 11.5
• lead	< 100 ppm	• [1]trichloroethylene	< 0.25%
• water	$\leq$ 70%	• [1]ethyl benzene	< 0.25%

These boundary conditions have been established so as to identify significant changes in waste characteristics and any anomalies in waste generation processes.

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[1] Trichloroethylene and ethyl benzene are used as solvents onsite, but they are not normally released to the wastewater treatment system.
[Note: This model waste analysis plan will not address the management of these spent solvents. A real waste analysis plan would be required to do so. A separate model plan in this manual (container storage) addresses this issue.]

TABLE 1. CHARACTERISTICS OF MOIST FILTER CAKE FROM WASTEWATER TREATMENT PLANT[1]

RCRA[2] Number	Associated Hazard	Physical State	Chemical Composition[3]
K002, K003, K004	Hexavalent chromium, lead (toxic)	Solid, single-layer	Total chromium: 50 to 200 ppm Lead: 20 to 70 ppm Water: 55 to 65% by weight pH: 9.7 to 11.0 Trichloroethylene: Not detectable Ethyl benzene: Not detectable

[1] Management of the filter cake falls under Process Code S03, storage in waste piles.

[2] These streams are listed in 40 CFR 261.32.

[3] Refers to composition of filter cake as it leaves vacuum filtration unit.

3. Waste Pile Tolerance Limits

The waste piles have the following limitations:

- The volume of filter cake in the waste pile must not exceed the design capacity in order to prevent spills.
- The waste pile should not receive any filter cake that contains greater than 70 percent water, so as to prevent the generation of liquids.
- The filter cake should not be waste piled if its pH falls outside the 9.0 to 12.0 range because this could potentially damage the liner.
- The waste pile should not receive any wastes that are incompatible with the filter cake or waste pile materials of construction (e.g., the PVC membrane liner) such as the trichloroethylene and ethyl benzene solvents used onsite. This avoids reactions that may lead to contamination of the area.

These tolerance limits represent those qualitative and quantitative waste characteristics that the waste pile structures can manage within the RCRA permit conditions.

4. Filter Cake Parameters to be Monitored

To select the appropriate waste parameters to monitor, The Color Company 1) reviewed existing information on the waste properties, 2) noted what properties best indicate any change in the filter cake, and 3) compared this information to the waste pile design criteria so that we can prevent any noncompliance with RCRA permit conditions.

Our operating experience has shown that the filter cake characteristics are only expected to vary in lead and chromium concentrations, the percent volume of water, and the pH. (See Appendix C of this Part B application for sample operating data.) The waste pile limitations in Section 3 confirm the need for measuring percent moisture and pH. It has been determined that the filter cake is neither ignitable nor reactive; therefore, it is unnecessary to test for these characteristics. (Test results are available upon request.)

The metal concentrations in the cake will vary depending on pigment production rates. Since the waste pile PVC liners are not sensitive to the concentrations of these metals, any changes would not influence the waste pile performance. However, chromium and lead are measured 1) to ensure compliance with the RCRA permit waste description, 2) to assure waste composition consistency, and 3) to be prepared should a spill occur onsite.

The percent volume of water in the filter cake is a factor that needs monitoring. Liquids should not be allowed to accumulate at the base of the waste pile; therefore, the filter cake must be sufficiently dewatered to minimize liquids. A vacuum filter cake should be able to retain 70 percent water. Any volumes greater than this may create liquids that could potentially leak and transport metals into the environment if the waste pile liner were damaged. The pH of the typical alkaline filter cake is measured to indicate a change in the filter cake's characteristics. Unusual filter cake pH values could damage the pile liner and cause leakage.

The Color Company has considered the potential for liner-damaging organic constituents to be present in the filter cake. Based on our knowledge that the pigment producing processes use no organics directly, we have no reason to suspect that liner-damaging organics would be present in the filter cake. However, trichloroethylene and ethyl benzene are used as cleaning solvents but are normally kept separate from the wastewater streams. We will analyze for these solvents to assure they are not present in the sludge.

We decided how often to characterize the filter cake by considering --

- the potential for other materials onsite to be mistakenly combined with the waste pile filter cake,
- the variability of the filter cake composition, and
- the likelihood of the filter cake undergoing changes that would alter its permitted characteristics.

The hazardous constituents, chromium and lead, are consistently present in the filter cake; only their concentration, the volume of water, and perhaps the pH may vary. The offsite hazardous waste management facility that accepts the waste pile material also analyzes it for their own purposes. For these reasons and the low probability that unscheduled wastes will be inadvertently mixed with the filter cake, we have decided to perform routine recharacterization annually. If there is any indication that an unusual quantity of leachate is being generated by the filter cake in the waste pile, an unscheduled sample will be taken and analyzed.

When the waste piles are emptied for offsite management, their bases are not decontaminated because they will be covered again with the same type of filter cake; therefore, no incompatibilities would exist. The transport vehicles are decontaminated by their owners before receiving the filter cake, and they are constructed of materials compatible with the sludge.

The filter cake from wastewater treatment is the only waste stored in the piles. However, if we ever suspect or are notified by one of our process area personnel that the pigment producing process or wastewater treatment process or their means of operation have changed, measures will be taken to determine if the filter cake has changed in character. We will obtain as much information about the change as our personnel can provide and take an unscheduled sample of the filter cake from the wastewater treatment plant. The sample will be split and one portion will be forwarded immediately to XYZ Labs, Inc. for analyses for chromium, lead, trichloroethylene, and ethyl benzene, and we will inform them of any suspected property changes in the sample. We will request results of the analyses within 72 hours. Should their analyses indicate a significant change in lead or chromium concentration or the presence of trichloroethylene or ethyl benzene, every effort will be made to characterize the waste so that we can 1) inform our offsite contractor of the change, 2) take measures to protect the waste pile liner, and 3) be prepared should a spill occur onsite.

Our personnel will analyze the unscheduled sample for pH and percent water. If the filter cake contains greater than 70 percent water, it will be returned to the plant for additional vacuum filtration. If the pH is outside the boundary conditions (i.e., pH 9.2 to 11.5), an additional characterization will be required to determine if waste components are present that could influence waste pile performance. Any analyses for nonroutine parameters that are required will be performed either in-house or by XYZ Labs.

The offsite hazardous waste management facility contractor who normally receives the waste pile material will be notified of any change in filter cake characteristics so that it can be determined if the waste is still acceptable at the facility. If it is not acceptable, The Color Company will make every effort to find another hazardous waste management facility to receive the filter cake. In the interim, the filter cake will remain stored onsite in a tanker truck.

5. Waste Sampling and Analysis

Sampling

Table 2 identifies the representative sampling information selected for the filter cake waste and for leachate that may accumulate in the waste pile sump.

It is practically impossible to sample all areas within each waste pile because access for sampling is limited to within a few feet of the pile's perimeter. Furthermore, sampling filter cake only around the perimeter would not be completely representative of all of the filter cake piled. Also it is important to know the moisture content, pH, and the potential presence of liner-damaging organic solvents in the filter cake before it enters the waste pile in order to prevent piling unacceptable wastes. Therefore, to solve the representative sampling problem and to monitor the moisture content of the waste, we sample the filter cake in the small temporary storage container at the vacuum filter area. From this container, a grab sample of the filter cake is taken randomly. We see no need to divide the temporary storage container into a grid for random sampling. The container is small (less than 5 cubic yards), limiting the potential for unusual variations in sample compositions. A standard G1-CM polyvinyl chloride trier will be used in sampling. This trier is nonreactive to the filter cake. Should any leachate be generated and collected in the waste pile sump, we will take a grab sample with a Coliwasa device or weighted bottle submerged near the bottom of the sump. Representative sampling techniques such as simple random sampling cannot be used in this case. All samples are stored in containers of nonreactive linear polyethylene (LPE) as described in SW-846, Section 1.2.2, until analysis.

We reviewed the scientific literature and our previous work history to identify any needs for special filter cake handling procedures. This helps us to be certain that our employees are protected and that the waste samples remain representative during storage.

The approach described above pertains to characterization and recharacterization sampling as well as to unscheduled sampling of the filter cake.

Quality assurance and quality control procedures for waste sampling are described in Appendix II.

Analysis

The wastewater treatment filter cake has been analytically characterized to assure its manageability onsite. The approach to choosing characterization parameters is described in Section 4 of this plan. Table 3 identifies the test methods for each parameter along with the rationale for the selection of each parameter. All of the analytical methods listed are EPA-approved. Quality assurance and quality control procedures for waste analysis are described in Appendix II. Our in-house wastewater treatment plant staff and XYZ Labs performed the initial characterization of the filter cake, and they will recharacterize it annually.

TABLE 2. FILTER CAKE SAMPLING INFORMATION

Stream (and Containment Device)	Sampling Method	Rationale for Selection of Sampling Technique	Comments
1. Moist filter cake from wastewater treatment plant (Temporary sludge storage container at vacuum filter area)	One grab sample with trier (SW-846, Section 1.2.1.5)	Grab sample preferred in order to avoid dilution by compositing.	1. Wear rubber gloves, apron, shoes, mask, and breathing apparatus. 2. Use linear polyethylene sample container. 3. Toxic.
2. Waste pile leachate, homogeneous liquid (Sump)	One grab sample with Coliwasa or weighted bottle. Sample near bottom of sump. (SW-846, Section 1.2.1.1).	Homogeneity of liquid requires only simple random sampling. If there is precipitation of any metal, highest concentration will occur near bottom.	1. Do not collect sample during rainfall. 2. Put in linear polyethylene container. 3. Potentially toxic.

TABLE 3. WASTE ANALYSIS PARAMETERS AND METHODS

Stream	Parameters	Analytical Methods[1]	Detection Limit (mg/L)	Rationale for Parameters
1. Moist filter cake from wastewater treatment plant[2]	Total chromium	AA Methods 3050/7190 (SW-846)	0.05	Verification of waste.
	Lead	AA Methods 3050/7420 (SW-846)	0.1	Verification of waste.
	Moisture	ASTM D95 - Distillation, or D1796 - Centrifuge	-	No more than 70% water allowed in waste.
	pH	pH Meter Method 9040 (SW-846)	-	Identification of corrosion threats.
	Trichloroethylene	GC Method 8010 (SW-846)	1.2×10^{-4}	Identify the presence of liner-damaging organics.
	Ethyl benzene	GC/MS Method 8240 (SW-846)	7.2×10^{-3}	Identify the presence of liner-damaging organics.
2. Waste pile leachate[3]	Total chromium	AA Methods 3010/7190 (SW-846)	0.05	Toxic parameter; reflects presence of filter cake constituents.

TABLE 3. (continued)

Stream	Parameters	Analytical Methods[1]	Detection Limit (mg/L)	Rationale for Parameters
	Lead	AA Methods 3010/7420 (SW-846)	0.1	Toxic parameter; reflects presence of filter cake constituents.
	pH	pH Meter Method 9040 (SW-846)	-	Assure effective wastewater treatment.
	Trichloroethylene	GC Method 8010 (SW-846)	1.2×10^{-4}	Identify the presence of liner-damaging organics.
	Ethyl benzene	GC/MS Method 8240 (SW-846)	7.2×10^{-3}	Identify the presence of liner-damaging organics.

[1] ASTM - American Society for Testing and Materials.
SW-846, "Test Methods for Evaluating Solid Waste," July 1982.
[2] Annual waste recharacterization is planned.
[3] Sump checked weekly for leachate collection. Will analyze as necessary.

TABLE 3. (continued)

Stream	Parameters	Analytical Methods[1]	Detection Limit (mg/L)	Rationale for Parameters
	Lead	AA Methods 3010/7420 (SW-846)	0.1	Toxic parameter; reflects presence of filter cake constituents.
	pH	pH Meter Method 9040 (SW-846)	-	Assure effective wastewater treatment.
	Trichloroethylene	GC Method 8010 (SW-846)	1.2×10^{-4}	Identify the presence of liner-damaging organics.
	Ethyl benzene	GC/MA Method 8240 (SW-846)	7.2×10^{-3}	Identify the presence of liner-damaging organics.

[1] ASTM - American Society for Testing and Materials.
SW-846, "Test Methods for Evaluating Solid Waste," July 1982.

[2] Annual waste recharacterization is planned.

[3] Sump checked weekly for leachate collection. Will analyze as necessary.

SAMPLE

APPENDIX I

XYZ LABORATORIES

Date: February 13, 1983

Sample Number: 1-1

Client: The Color Company

Collected: February 12, 1983
Received: February 12, 1983

Sample Number	Process Area Stream	Parameter	Results	Test Method[1]
1-1	1.	Total chromium	100 ppm	3050/7190
		Lead	50 ppm	3050/7420
		Trichloroethylene	Not Detectable	8010
		Ethyl benzene	Not Detectable	8240

[1] "Test Methods for Evaluating Solid Waste," SW-846. July, 1982. (Atomic Absorption Methods)

Signature of Certification: Jane Doe

Jane Doe, President

Appendix II

Quality Assurance/Quality Control Program

Program Goal

The program's goal is to obtain accurate and precise waste analysis data and maintain up-to-date documentation of those data. The analytical data we obtain are available --

- to prevent any damage to the waste pile structure by the filter cake,
- should a spill occur onsite, and
- so we can notify our offsite hazardous waste management facility contractor if a process or operation change is reflected in the filter cake characteristics.

The quantity of data we need to attain our goals is not major. We have no onsite disposal, and our offsite hazardous waste management facility analyzes the sludge also for their purposes.

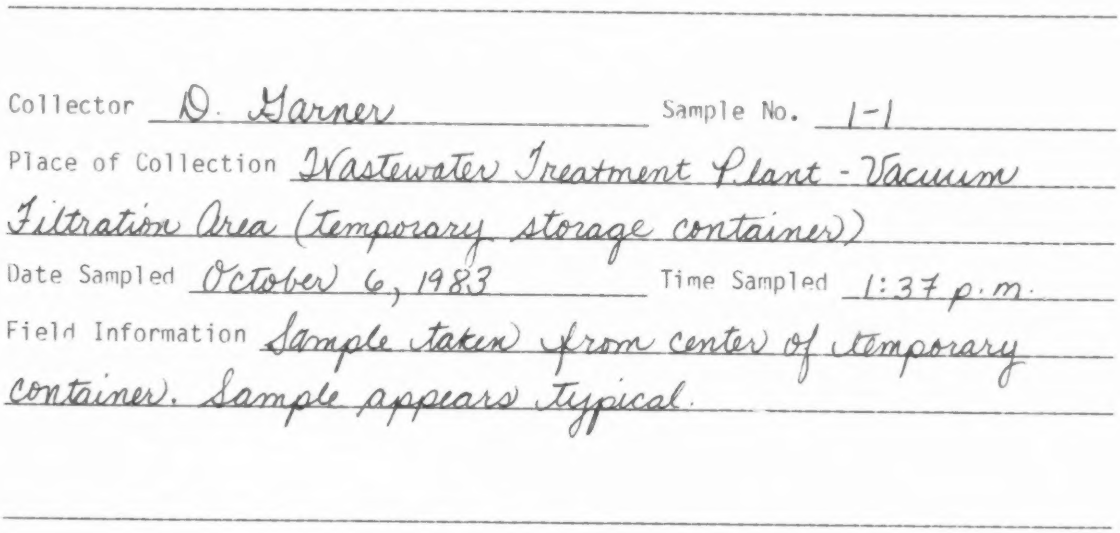
Sampling Program

We sample and analyze the waste except that the analyses for chromium, lead, trichloroethylene, and ethyl benzene are performed by XYZ Labs. Two people on the wastewater treatment plant staff serve as both samplers and analysts, and they have been properly trained to use the sampling and analytical equipment described in Section 5. A description of their training is found in the "Training Program" chapter of this Part B application. Their sampling skills are observed annually by our environmental manager during the sampling sessions. We believe this is a sufficient frequency since characterization sampling routinely occurs annually.

Once a sample is taken, the trier is decontaminated. When samples are taken, the employee logs vital data in a field book, labels the containers (see Figure II-1), and hand carries them to a designated storage area until XYZ Labs picks up the samples (within 24 hours). Our sampling employee prepares a request for analysis for those samples sent offsite for analysis (see Figure II-2) and then proceeds to analyze the filter cake (within 24 hours) for all remaining parameters at the wastewater treatment plant laboratory.

Analysis Program

The Color Company's two trained analysts are monitored by the environmental manager during filter cake analyses. The test methods used



Collector D. Garner Sample No. 1-1

Place of Collection Wastewater Treatment Plant - Vacuum Filtration Area (temporary storage container))

Date Sampled October 6, 1983 Time Sampled 1:37 p.m.

Field Information Sample taken from center of temporary container. Sample appears typical.

Figure II-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

Collector D. Garner Date Sampled 10/6/83 Time 1:37 p.m. Hours

Affiliation of Sampler employee - The Color Company

Address 400 (number) Smith St. (street) Hartsdale (city) - - (state) 00000 (zip)

Telephone (000) 555-1212 Company Contact T. Johnson

LABORATORY SAMPLE NUMBER	COLLECTOR'S SAMPLE NO.	TYPE OF SAMPLE[1]	FIELD INFORMATION[2]
TCC-1	1-1	sludge filter cake	Sample appears typical

Analysis Requested Measure total chromium, lead, trichloro-ethylene, and ethyl benzene

Special Handling and/or Storage Wear rubber gloves, apron, shoes, mask, and breathing apparatus. TOXIC.

PART II: LABORATORY SECTION[2]

Received by J. Russell Title Lab Mgr, XYZ Labs Date 10/7/83

Analysis Required Total chromium, lead, trichloroethylene, and ethyl benzene.

[1] Indicate whether sample is soil, sludge, etc.

[2] Use back of page for additional information relative to sample location.

Figure II-2. Sampling analysis request.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

follow quality assurance/quality control procedures outlined in each EPA-approved method. The analysts register the receipt of each sample in the lab log before analysis begins.

The analytical data we generate are documented and kept on-file in the environmental manager's office. The lab equipment used is inspected and serviced semiannually and as required on a nonroutine basis. Any leftover sample from the analysis is returned to the waste pile.

All atomic absorption analysis procedures have been specified in the Color Company's contract with XYZ Labs. XYZ is a commercial laboratory with trained analysts who are retrained annually. They maintain a rigorous quality assurance/quality control program that is available for review by EPA upon request. All of the hazardous waste analyses are performed within 72 hours of receiving the sample. The analyses comply with SW-846 quality assurance/quality control procedures for specific test methods. XYZ Labs document their analytical data and return them to us for evaluation and filing in the environmental manager's office.

MODEL WASTE ANALYSIS PLAN

LAND TREATMENT[1]

1. Facility Description

The Refining Company is a refiner of petroleum products. The treatment of wastewater from the refining process generates two hazardous wastes, dissolved air flotation (DAF) float and American Petroleum Institute (API) Separator sludge. These wastes are listed as hazardous in 40 CFR Part 261 primarily because of their toxic levels of lead and hexavalent chromium; however, toxic organics may also be present in the wastes.

The Refining Company desires to obtain a RCRA permit to land treat the DAF float and API Separator sludge on its site. The land treatment process involves spreading the wastes over a designated plot of land followed by continued management. The soil and applied wastes are tilled to promote waste degradation, transformation, and immobilization within a given depth of soil (treatment zone) as defined in the permit. Only the DAF float and the API Separator sludge generated by us onsite will be treated at the facility. No nonhazardous waste streams will be land treated at this facility.

As required under RCRA, a land treatment demonstration will be performed for EPA. The results of this demonstration will indicate successful degradation, transformation, or immobilization of hazardous constituents in the waste. Another chapter of this Part B application provides a detailed description of the proposed treatment demonstration plan.

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[1] This waste analysis plan will not address the storage of hazardous waste before land treatment. A real waste analysis plan would be required to do so, but it is excluded here because a separate model plan has been prepared for a storage facility.

2. Identification of Wastes Treated

Table 1 identifies general physical and chemical characteristics of the two types of wastes to be land treated. The API Separator sludge is high in solids, having a heavy sludge character. It is not flowable as a liquid. The DAF float is flowable and is handled more like a liquid because of its low solids content.

The waste characteristics in Table 1 are based on analyses performed over the past year by our in-house staff using EPA-recommended methods. The Appendix VIII analyses were done according to the methods described by EPA in guidance memoranda issued on April 3, 1984, and May 25, 1984. Quality assurance and quality control procedures used to characterize the wastes are described in the appendix to this waste analysis plan.

After completion of the treatment demonstration, the Refining Company will propose principal hazardous constituents (PHCs) for use as indicator parameters for unsaturated zone monitoring at the full-scale land treatment unit. PHCs will be selected on the basis of their ability to indicate the fate (degradation, transformation, and immobilization) of all hazardous constituents in the waste. A more detailed discussion of PHCs is provided in the unsaturated zone monitoring plan.

The Refining Company has established boundary conditions for the API Separator sludge and the DAF float based on the results of recent and past analyses of these wastes at our plant. The Refining Company will use the waste stream boundary conditions shown in Table 2 to determine if a given batch of waste has characteristics that are typical of the API Separator sludge or DAF float that the Refining Company land treatment facility is permitted to manage. These conditions were selected based on waste analysis data from our years of operation. If the characteristics of a given batch of waste fall outside these boundary conditions, the Refinery Company will conduct a more detailed investigation of the waste batch and notify EPA of our findings. Section 4 describes in detail the Refinery Company's approach to boundary condition analyses. Based on our years of operating experience, we would not expect the waste to fall outside these limits. (Operating records are available upon request.)

TABLE 1. WASTE CHARACTERISTICS

Stream[1,2]	Basis for Hazard	Physical Properties	Chemical Composition
1. API Separator Sludge (RCRA No.[3] K051)	Chromium, Lead (Toxic)	Density: 1.35 to 1.65 g/ml	Water: 48 to 58% by weight Electrical conductivity: 1 to 3 mmhos/cm pH: 2.5 to 4 Oil: 20 to 26% by volume Solids: 21 to 27% by weight Total organic carbon: 8,250 to 9,450 Total chromium: 2,000 to 4,000 mg/kg Lead: 300 to 600 mg/kg Additional 40 CFR 261 Appendix VIII constituents:[4]
2. DAF Float (RCRA No.[3] K048)	Chromium, Lead (Toxic)	Density: 1.15 to 1.45 g/ml	Water: 77 to 87% by weight Electrical conductivity: 2 to 4 mmhos/cm pH: 2.5 to 4 Oil: 11 to 14% by volume Solids: 2 to 8% by weight Total organic carbon: 4,600 to 5,400 Total chromium: 25 to 100 mg/kg Lead: 250 to 500 mg/kg Additional 40 CFR 261 Appendix VIII constituents:[4]

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[1] Process code for both streams is D81.
[2] Both streams are single layer wastes.
[3] Refer to 40 CFR 261.32.
[4] Information on specific Appendix VIII constituents was not available for this model.

TABLE 2. WASTE STREAM BOUNDARY CONDITIONS

Parameter	API Separator Sludge	DAF Float
Total Chromium (mg/kg)	1,500 to 4,500	0 to 150
Lead (mg/kg)	250 to 825	200 to 750
Water (% by weight)	30 to 70	70 to 95
Electrical conductivity (mmhos/cm)	0 to 5	0 to 6
pH	2.5 to 6	2.5 to 5.5
Total organic carbon (TOC) (mg/L)	8,000 to 9,750	4,300 to 5,700
Total phenols (μg/g)	0 to 150	0 to 75

3. Land Treatment Process Tolerance Limits

Tolerance limits represent those characteristics of a waste or waste mixture that a management process, e.g., land treatment, can handle within the facility's permit conditions. For this land treatment facility, the process is limited in that we will be permitted to treat only those wastes with characteristics designated in the permit, i.e., DAF float and API sludge. We plan to apply these wastes separately to different land treatment plots.

A treatment demonstration will be conducted to prove that each waste can be land treated at the proposed facility without pretreatment. The design and management parameters for the proposed land treatment facility will be established in the permit based on this demonstration. Because the demonstration will be made using waste typical for the Refinery Company, the waste stream boundary conditions, as defined in Table 2, can also serve as the tolerance limits. The design and management conditions employed to successfully manage these wastes at the land treatment facility are defined in the facility Operating Plan of this Part B application. Any deviation from these typical waste characteristics would require a modification to the Operating Plan.

The primary boundary condition parameters that can also serve as tolerance limits are--

- pH values (Note: The pH of the waste (2.5-4) is not favorable regarding mobility; the permit conditions will require liming to raise the pH),

- electrical conductivity to estimate the soluble salts that may limit treatment efficiency, and

- water content and metals and organics concentrations to assure that the appropriate application rate is selected based on constituent concentrations that do not hinder treatment performance.

Numerical values for these parameters are found in Section 2.

4. Waste Parameters to be Monitored

This section identifies the waste parameters that will be monitored to generate the information that the Refinery Company needs to properly manage the API Separator sludge and DAF float at the proposed land treatment unit. We have selected waste parameters that allow us to 1) demonstrate that the waste characteristics are within the established boundary conditions, 2) address process tolerance limits, and 3) successfully manage the waste at the land treatment unit in accordance with 40 CFR Part 264, Subpart M.

To select the appropriate waste parameters, we 1) reviewed existing information on the waste properties, 2) noted what properties best indicate any change in waste characteristics that affect treatability, and 3) compared this information to our treatment process design criteria so that we can prevent any noncompliance with RCRA permit conditions. Since the RCRA permit will be based on the type of waste treated, waste analysis parameters were chosen based on those waste characteristics that affect treatability.

The following parameters have been selected to monitor boundary conditions/tolerance limits: water content, electrical conductivity, pH, total organic carbon, and Appendix VIII hazardous constituents including total chromium and lead. Of the Appendix VIII constituents, principal hazardous constituents (PHCs) will be monitored frequently. A complete scan for the 89 Appendix VIII constituents specified by EPA will be performed with periodic waste recharacterizations. [Refer to EPA's April 3, 1984, memorandum on land teatment and Appendix VIII constituents.] Because our wastes may contain low concentrations of various phenolic compounds that are not biodegraded easily, EPA has required that total phenols be measured. Exceeding the boundary conditions/tolerance limits for the waste characteristics could result in untypical wastes that could contaminate the environment beyond the designated treatment zone. Parameters to be monitored for RCRA waste characteristics include ignitability (flash point), reactivity, and EP toxic metals in addition to total chromium and lead. These characteristics will be monitored with periodic waste recharacterizations. Specific gravity will be measured to help verify waste characteristics.

In selecting waste characteristics to monitor, we also considered the potential for halogenated organic constituents to be present in the sludges. Based on our waste analyses of the sludge over the years and records of sludges from similar refining facilities within our company, there is no evidence that halogenated organics would be present in the sludge. (These data are available upon request.)

Although a very low probability exists that wastes not permitted for treatment could be mistakenly combined with the permitted wastes, such a mistake could reduce land treatment performance. We must be sure that the wastes we handle are the DAF float and API Separator sludge and that the wastes do not contain nonpermitted components (i.e., boundary conditions are met). This assurance is provided by sufficiently analyzing the wastes as described in this plan. We decided how often we felt it necessary to characterize the waste with these tests by considering--

- the potential for other materials onsite to be combined with the wastes by mistake,
- the variability of waste composition, and
- the likelihood of the sludge undergoing changes that alter its permitted characteristics.

Experience has shown that the concentrations of chromium and lead in the wastes are relatively consistent over time. However, we plan to analyze the wastes quarterly for these and other key parameters because the potential exists for environmental contamination if untypical wastes cause the treatment process to perform poorly. Complete waste characterizations will be performed annually to provide an accurate profile of the wastes. All analyses will be performed in-house, and results will be recorded on the characterization form shown in Figure 1. Should the quarterly analyses or annual recharacterizations indicate that one or more of the waste parameters are outside the permit conditions, we will handle the waste as described below.

If we are ever notified by one of the process area personnel that the refining or wastewater treatment process or the means of operation have changed, we will check the wastes for changes in character. After obtaining as much information about the change as our personnel can provide, we will take an unscheduled sample from the tanks and completely characterize it in the onsite labs. The characterization results will be evaluated to decide if the waste characteristics are within the permitted ranges. If the waste characteristics do not comply, we will make every effort to find an offsite commercial hazardous waste management facility to receive the waste. In the interim, the waste will remain stored onsite in mobile tanks or open bed trucks.

The Refining Company (Generator)
P.O. Box 00
Anytown, USA 00000

EPA ID Number USA 000000000

Date __________________

1. Waste Identification

    a. Facility Waste Number __________ Sample Number _____
    b. RCRA Waste Number __________
    c. DOT Waste Number __________
    d. Name of Waste
    e. General Description of Waste Generation Process

2. Sampling

    a. Date Sampled b. Sampling Method
    c. Name and Affiliation of Sampler
    d. Was sample taken during normal process operation? ____ Yes ____ No

3. Physical State at 21° C (70° F) _____ Solid _____ Sludge _____ Liquid

4. Specific Gravity

5. Percent Water (Free Liquids) Test Method

6. Electrical Conductivity Test Method

7. Corrosive _____ Yes _____ No pH (regardless of corrosivity) _____

Figure 1. Characterization form.

8. Ignitable _____ Yes _____ No Flash Point _____ ° C _______ ° F

Test Method

9. Reactive _____ Yes _____ No Test Method

Description of Results

10. EP Toxic Metals _____ Yes _____ No

Contaminant	Concentration	Method of Analysis

11. Total Organic Carbon (mg/L) Test Method

12. Organic Components (Including PHCs and Total Phenols) (percent by wt. or mg/L)

Test Method

Authorized Signature ______________________________

Title and Date ______________________________

Figure 1. Characterization form (continued).

5. Waste Sampling and Analysis

Sampling

The approaches described below pertain to characterization and recharacterization as well as to unscheduled sampling of the DAF float and API Separator sludge.

The DAF float is stored temporarily in an enclosed mobile tank before it is spread over the land treatment area. This tank serves as a sampling point to determine if the waste is treatable. We sample the float at three vertical points from the access port in the tank. We choose not to composite the three ports' samples because the concentration of heavy metals may not be evenly distributed throughout the tank. Compositing samples with different concentrations may mask the true metals concentrations in the sludge as it is pumped from the tank to the land. For example, if the bottom of the tank contained a high lead concentration, too much lead would be applied to an area of land. This could hinder the treatment zone's performance and contaminate soils outside the zone. A Coliwasa constructed of Type 316 stainless steel is used to sample the float (SW-846, 1.2.1.1). The collected sample is then placed in a container made from nonreactive linear polyethylene (LPE) (SW-846, 1.2.2).

The API sludge is sampled at each API Separator. Random grab samples are taken at three points within an imaginary, 3-dimensional grid of the sludge in the separators. [See Appendix C of this manual.] In order to obtain a reliable profile of key parameters in the sludge, the samples are not composited because the potential exists for uneven distribution of metals that have settled in the separators. The sludge is sampled with a trier constructed of Type 316 Stainless Steel (SW-846, 1.2.1.5), and the sample is stored in LPE containers (SW-846, 1.2.2).

We reviewed the scientific literature and our previous work history to identify any needs for special waste handling procedures that are necessary to ensure the safety of our employees who sample or handle the waste and to assure that the waste samples remain representative during storage.

Table 3 contains information pertaining to all the sampling procedures described, including safety precautions. Quality assurance and quality control procedures for sampling waste are described in the appendix.

Analysis

Table 4 identifies test methods for each waste parameter to be measured. Detection limits are provided for some methods where applicable. The table also includes the rationale for choosing each parameter as discussed in Section 4. The test methods were selected from EPA's "Test Methods for Evaluating Solid Waste" (SW-846), the American Society for Testing and Materials (ASTM) compendium of test methods, and the American Public Health Association's Standard Methods for the Examination of Water and Wastewater. Quality assurance and quality control procedures for waste analysis are discussed in the appendix.

TABLE 3. WASTE SAMPLING INFORMATION

Stream	Containment Device	Sampling Method	Comments
DAF Float	Temporary storage tank	Grab sample with Coliwasa (SW-846,[1] Sections 1.4.2 and 1.2.1.1)	1. Wear goggles and rubber gloves. 2. Store sample in LPE containers. 3. Grab one sample at each of three depth levels. 4. Toxic waste.
API Separator Sludge	API Separator	Random grab sample with trier (SW-846, Section 1.2.1.5)	1. Wear goggles, rubber gloves, and apron. 2. Store sample in LPE containers. 3. Grab one sample at each of three grid areas randomly selected in the separator. 4. Toxic waste.

[1] SW-846, "Test Methods for Evaluating Solid Waste," July 1982.

TABLE 4. WASTE ANALYSIS INFORMATION FOR API SEPARATOR SLUDGE AND DAF FLOAT[1]

Parameters	Analytical Methods	Detection Limit (μg/L)	Rationale for Parameters
Specific gravity	ASTM D1429, Method C (Erlenmeyer Flask)	-	Verification of waste.
*[2]Percent water	ASTM D95 - Distillation, or D1796 - Centrifuge		Treatment performance affected by percent water in waste.
*Electrical conductivity	Method 9045 (SW-846)[3]	-	Treatment performance affected by conductivity of waste.
*pH	pH Meter Method 9040 (SW-846)	-	Treatment performance affected by pH of waste.
Flash Point	Method 1010-Closed cup (SW-846)	-	Check for ignitability to assure safe handling.
Reactivity	U.S. Gap Test or U.S. Internal Ignition Test[4]	-	Check for explosivity to assure safe handling
Arsenic	AA Method 7061 (SW-846)	2	Identify unexpected constituents.
Barium	AA Methods 3030/7080 (SW-846)	100	Identify unexpected constituents.
Cadmium	AA Methods 3030/7130 (SW-846)	5	Identify unexpected constituents.
*Total chromium	AA Methods 3030/7190 (SW-846)	50	Verification of waste and reference to assess treatment performance.
*Lead	AA Methods 3030/7420 (SW-846)	100	

TABLE 4. (continued)

Parameters	Analytical Methods	Detection Limit (μg/L)	Rationale for Parameters
Mercury	AA Method 7471 (SW-846)	0.2	Identify unexpected constituents.
Selenium	AA Method 7741 (SW-846)	2	Identify unexpected constituents.
Silver	AA Methods 3030/7760 (SW-846)	10	Identify unexpected constituents.
*Total organic carbon	APHA[5] 505	-	Treatment performance affected by organic content of waste.
*Total phenols	Method 8040-Gas chromatograph (SW-846)	-	Required by EPA because of slow biodegradation and effect on treatment.
Appendix VIII Constituents:			
Volatile organics	Method 8240-Gas chromatograph/ mass spectrometer (SW-846)	1μg/g	Identify Appendix VIII constituents and assess treatment performance.
Semivolatile organics	Method 8270-Gas chromatograph/ mass spectrometer (capillary column technique) (SW-846)	1μg/g	Identify Appendix VIII constituents and assess treatment performance.

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[1] Quarterly key analyses and annual recharacterizations are performed.

[2] An asterisk indicates parameters are monitored quarterly.

[3] SW-846, "Test Methods for Evaluating Solid Waste," July 1982.

[4] [Author's note: These explosivity tests are currently under development by the Bureau of Mines for EPA.]

[5] APHA American Public Health Association Standard Methods for the Examination of Water and Wastewater 15th edition, 1980.

APPENDIX

Quality Assurance/Quality Control Program

Program Goal

The program's goal is to collect accurate and precise waste characteristic information so that we can assure that the wastes treated at our faciity reflect those waste characteristics that the process is permitted to treat. This can be accomplished by making sure that the waste maintains the permitted characteristics of DAF float and API sludge. We generate a great deal of data at our facility, and the success of the treatment process is especially dependent on the quality of these analytical data. Thus, this quality assurance/quality control program is carried out to the fullest to assure that accurate and precise data are obtained.

Sampling Program

Two of our personnel will be trained to sample wastes as described in this application's training program section. Their sampling skills are observed quarterly during sampling events by our operations manager. Sampling equipment is inspected for decontamination and operability before each shipment is sampled, and each inspection is documented. We make note of any problems encountered and the corrective actions taken.

All sample containers are labeled (see Figure A-1), and vital sampling information is logged in the field before the sampler drives the samples to the laboratory (see Figure A-2).

Analysis Program

Our lab personnel have been trained to perform the analytical procedures discussed in Section 5 of this waste analysis plan, and their training program is described in this Part B application. Analytical skills are checked with the blanks or standards that are included with each analysis. Lab personnel document receipt of each sample and assign sample identification numbers to replicates. The quality assurance/quality control procedures for analysis follow those outlined in each EPA-approved test method. Upon receipt of the sample, a lab employee logs it into the daily lab record. Tests are completed at least 24 hours before land application to identify any anomalies in time. All test results are documented on the characterization form shown in Figure 1.

Analytical equipment is inspected and serviced semiannually in addition to routine checks before each analysis. Leftover samples are returned to the containment devices from which they were sampled.

Collector R. Cates Sample No. 2-2

Place of Collection DAF Float Tank

Date Sampled August 13, 1983 Time Sampled 10:00 a.m.

Field Information Float sample is wetter than normal. Rainy weather during sampling.

Figure A-1. Sample container label.

Source: "Test Methods for Evaluating Solid Waste" SW-846, July, 1982.

Sample Identification Number 2-2

Date 8/13/83
Time 10:00a.m.

1. Waste Identification

   Dissolved Air Flotation float

2. Purpose of Sampling

   Quarterly analysis

3. a. Sampling Point Location
   b. Description Temporary storage tank B
   Grab sample taken midway into tank through the only access port

4. a. Number of Samples Taken

   One

   b. Volume per Sample

   One liter

5. Any Field Measurements Taken No

   Parameter

   Measurement

6. Observations During Sampling Float sample seems wetter than normal. Rainy weather during sampling.

7. a. Sample Destination

   In-house laboratory

   b. Means of Transport

   Truck

Signature of Sampling Person: R. Cates

Figure A-2. Field log.
Source: "Test Methods for Evaluating Solid Wastes", SW-846, July 1982.

MODEL WASTE ANALYSIS PLAN

INCINERATION[1]

1. Facility Description

The Controlled Combustion Company operates a commercial hazardous waste incinerator, receiving wastes transported in tankers from offsite generators.

We are requesting a RCRA permit to incinerate halogenated and nonhalogenated solvent distillation recovery bottoms, in particular, from the spent solvents methylene chloride, trichloroethylene, and acetone. These wastes are designated RCRA hazardous because the first two contain toxic compounds and the third contains an ignitable compound. These wastes do not exhibit any reactive or corrosive characteristics. It is anticipated that we will accept additional wastes for incineration in the future.

The wastes described above require no treatment before incineration. They are documented as mutually compatible by "A Method for Determining the Compatibility of Hazardous Wastes" (EPA-600/2-80-076) and can be stored in a common area before incineration.

The incinerator is designed to destroy and remove 99.99 percent of the wastes' principal organic hazardous constituents (POHCs) so that little or no emissions to the environment will occur. Trial burns have been conducted for EPA using methylene chloride as the indicator POHC. The trial burns destroyed and removed more than 99.99% of the methylene chloride and maintained performance standards (40 CFR 264.343) in which the trial burn material contained 5 percent chloride, 5 percent water, and 30 percent ash.

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[1] This model waste analysis plan will not address the container and tank storage of the wastes onsite since storage is addressed in other model plans. A real waste analysis plan would be required to detail the storage aspects of the facility.

2. Identification of Wastes to be Incinerated

The Controlled Combustion Company plans to incinerate distillation recovery bottoms from spent methylene chloride, trichloroethylene, and acetone in accordance with the RCRA permit. Other wastes may be incinerated in the future as long as the heats of combustion of each organic constituent in each waste feed are greater than that of methylene chloride (POHC), i.e., they can be burned more efficiently. Heats of combustion must be greater in order to assure that 99.99% of the constituents are destroyed and removed as was demonstrated in the trial burns with methylene chloride. The ash content, chloride content, viscosity, and water content of each waste feed must be less than that of the trial burn feed. Any waste feeds that do not meet these conditions are restricted from incineration.

Table 1 contains the pertinent characteristics of each hazardous waste to be incinerated. Our staff sampled and analyzed each of the wastes to provide the initial characterization. They visited each generator's site and collected samples three times at 2-week intervals. Table 1 reflects the analytical results of those sample analyses. (Quality assurance and quality control programs for sampling and analysis are described in Appendix I.) Each generator allowed us to review their waste analysis data over past years which also agreed with our test results. This initial characterization served to establish that each of the wastes fell into one of the waste categories intended for incineration. Figure 1 is the waste characterization form completed for each waste.

Based on our waste analyses and discussions with generators about the consistency of their wastes, we have selected waste stream boundary conditions of ± 15 percent of the limits provided in Table 1. These boundary conditions will alert us to any untypical wastes arriving at the facility that may affect incinerator performance. We do not anticipate that the waste characteristics will fall outside this range. If they do, we will follow the contingency procedures described in Section 4, "Parameters to be Monitored."

TABLE 1. WASTE CHARACTERISTICS[1]

Stream[2,3]	RCRA Number[4]	Basis for Hazard Listing	Physical Properties	Chemical Composition
A-1 Recovery Still Bottoms of Spent Halogenated Solvent	F001	Methylene chloride (Toxic)	Specific gravity: 0.95 to 1.15 Heat of combustion: 7.49 to 9.16 kcal/g (13,500 to 16,500 Btu/lb) Ash: 5 to 7% by weight Viscosity: 19 to 22 Centipoise	Methylene chloride: 18 to 22% by volume Oil: 76 to 80% by volume Water: 1 to 3% by weight
A-2 Recovery Still Bottoms of Spent Halogenated Solvent	F001	Trichloroethylene (Toxic)	Specific gravity: 1.02 to 1.24 Heat of combustion: 5.99 to 7.33 kcal/g (10,800 to 13,200 Btu/lb) Flash point: $>32^{\circ}$ C (pure TCE, closed cup) Ash: 3 to 6% by weight Viscosity: 16 to 19 Centipoise	Trichloroethylene: 28 to 32% by volume Oil: 66 to 70% by volume Water: 1 to 3% by weight

TABLE 1. (continued)

Stream[2,3]	RCRA Number[4]	Basis for Hazard Listing	Physical Properties	Chemical Composition
B-1 Recovery Still Bottoms of Spent Nonhalogenated Solvent	F003	Acetone (Ignitable)	Specific gravity: 0.80 to 1.02 Heat of combustion: 8.32 to 9.99 kcal/g (15,000 to 18,000 Btu/lb) Flash point: $> -20^{\circ}C$ (pure acetone, closed cup) Ash: 8 to 11% by weight Viscosity: 14 to 17 Centipoise	Acetone: 23 to 27% by volume Oil/wax: 71 to 75% by volume Water: 1 to 3% by weight
C-1 Recovery Still Bottoms of Spent Halogenated Solvent	F001	Methylene chloride (Toxic)	Specific gravity: 0.95 to 1.19 Heat of combustion: 6.99 to 8.55 kcal/g (12,600 to 15,400 Btu/lb) Ash: 9 to 13% by weight Viscosity: 18 to 21 Centipoise	Methylene chloride: 23 to 27% by volume Oil: 71 to 75% by volume Water: 1 to 3% by weight

[1] Process code for all streams is T03, incineration.
[2] Stream letters indicate generator (A, B, or C) as well as the separate stream numbers from each generator.
[3] All streams are single layer liquids.
[4] 40 CFR Part 261.31.

---

1. Generator   Date ____________

    a. Name

    b. Address

    c. EPA ID Number ____________

2. Waste Identification

    a. Facility Waste Number ________ Sample Number ____

    b. RCRA Waste Number ________

    c. DOT Waste Number ________

    d. Name of Waste

    e. General Description of Waste Generation Process

3. Sampling

    a. Date Sampled   b. Sampling Method

    c. Name and Affiliation of Sampler

    d. Was sample taken during normal process operation? ____ Yes ____ No
    If no explain:

4. Physical State at 21° C (70° F) _____ Solid _____ Sludge _____ Liquid

5. Specific Gravity

6. Viscosity (Centipoise) Test Method

7. Water Content (percent) Test Method

Figure 1. Waste characterization form.

---

8. Total Organic Carbon (ppm) Test Method

9. Heating Value (kcal/g.) Test Method

10. Ash Content (percent) Test Method

11. Corrosive _____ Yes _____ No Test Method

12. Ignitable _____ Yes _____ No Flash Point _____ ° C _____ ° F

Test Method

13. Reactive _____ Yes _____ No Test Method

Description of Results

Figure 1. Waste characterization form (continued).

14. Other Inorganic Components (Indicate percent by weight or mg/L) Test Method

15. Organic Chloride Test Method

16. Organic Components (Indicate percent by weight or mg/L and if a designated Appendix VIII POHC) Test Method

I certify the accuracy of this data and the representativeness of the waste sample.

Signature and Title ______________________

Date ____________________

Figure 1. Waste characterization form (continued).

3. Incinerator Tolerance Limits

The waste feed to the incinerator must be semisolid or liquid and have a heating value that meets the temperature requirements of the incinerator. The total feed rate to the incinerator must range from 7.56 X 10^6 kcal/hr (30 X 10^6 Btu/hr) to 1.26 X 10^7 kcal/hr (50 X 10^6 Btu/hr). The heating value of each organic constituent in the waste feed must be greater than the heating value for the pure indicator POHC designated at trial burn - methylene chloride (1.7 kcal/g (3,067 Btu/lb)). Methylene chloride attained a 99.99 percent destruction and removal efficiency during the trial burn. The chloride content of the waste feed must not exceed 5 percent. This limit leads to optimum scrubber removal of chloride emissions. This value is the maximum concentration for which compliance with incinerator performance standards was demonstrated during the trial burn. The waste feed must not have a water content greater than 5 percent, because water reduces heating value and, in turn, burning efficiency. Also, two types of problems can arise if sufficient water is present to cause phase separation: 1) the potential for equipment damage if freezing occurred, and 2) perturbation of the combustion process if a slug of water were introduced into the feed. Complying with these limits helps ensure that 99.99 percent of the POHCs will be destroyed and removed. Ash content of the waste feed must be less than 30 percent in order to comply with particulate emissions standards.

4. Parameters to be Monitored

The distillation recovery bottoms must meet the chemical and physical requirements specified in the incinerator permit. To select the analysis parameters to represent the waste characteristics, we 1) reviewed existing information on the waste properties such as generator data and EPA's Background Information Document for the specific waste, 2) noted what properties best indicate any change in the waste, and 3) compared this information to the incinerator design criteria and trial burn test results.

The three categories of wastes are analyzed for specific gravity, viscosity, elemental analysis (including metals), and total organic carbon to verify waste composition; corrosivity, reactivity, and flash point to assure safe handling. Percent water, ash content, and heat of combustion are monitored to assess various aspects of incinerator performance. Wastes are scanned by GC/MS for the presence of hazardous constituents. Also, waste-specific parameters to be determined are methylene chloride, trichloroethylene, organic chloride (total organic halogens), flash point, and acetone. POHCs are monitored to estimate destruction and removal efficiency. All the wastes we intend to manage are mutually compatible; therefore, we see no need to test routinely for compatibility.

We plan to recharacterize the wastes periodically to identify changes that cannot be verified by waste shipment screenings. The frequency for recharacterizing the wastes was selected by considering --

- the potential for restricted waste being combined in a shipment,
- the variability of the waste composition between shipments,
- the likelihood of a waste undergoing changes that alter its permitted characteristics, and
- the prior history of the waste generator.

Section 5, "Wastes Sampling and Analysis," contains a description of the analysis procedures to be followed and identifies the frequencies of waste recharacterization.

We screen shipments, because the potential may exist for generators to include, by mistake, wastes other than those permitted for incineration at our facility. This could affect the incinerator's destruction and removal efficiency by reducing the heating value of the waste, for example. Figure 2 displays the sequence of events that are to be followed when waste shipments arrive at our facility. We developed the screening procedures based on our knowledge of the generators and the wastes they ship.

When a waste shipment arrives at the facility, we first check the manifest for completeness and correctness. At a minimum, we will look for the following information on each manifest:

- a manifest document number;

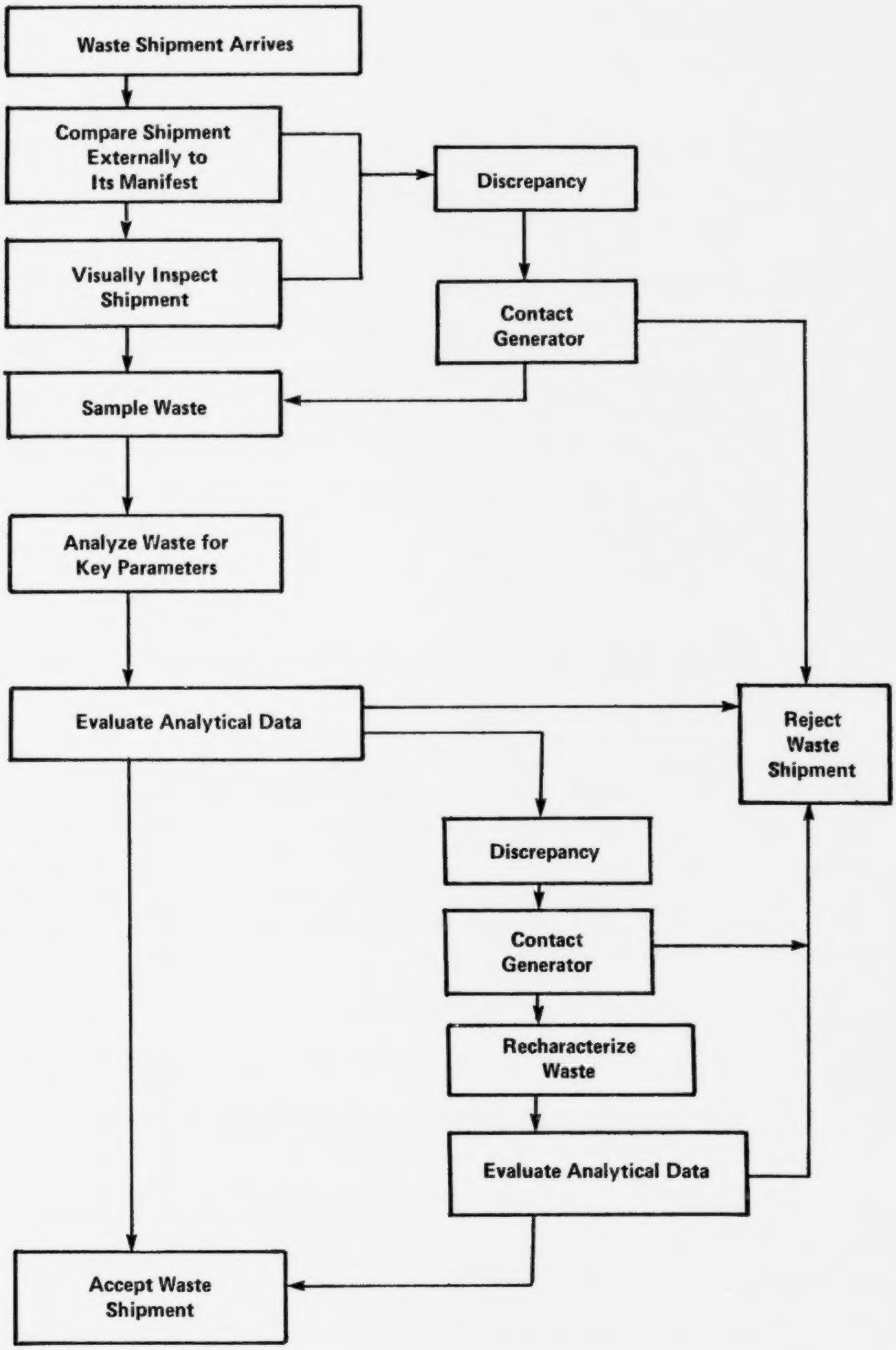
Waste Shipment Arrives
Compare Shipment Externally to Its Manifest
Visually Inspect Shipment
Discrepancy
Contact Generator
Sample Waste
Analyze Waste for Key Parameters
Evaluate Analytical Data
Reject Waste Shipment
Discrepancy
Contact Generator
Recharacterize Waste
Evaluate Analytical Data
Accept Waste Shipment

Figure 2. Shipment screening procedures.

- the generator's name, address, and EPA identification number;
- each transporter's name and EPA identification number;
- the destination of the waste shipment, i.e., hazardous waste management facility, address, and EPA identification number;
- an alternative hazardous waste management facility, address, and EPA identification number;
- a Department of Transportation shipping name and number;
- the quantity or volume of waste in the shipment; and
- a signed certification of the shipment's content.

The shipment will be inspected visually, noting --

- if the shipment labels/placards match the manifest;
- any irregularities in the shipment (e.g., leaks);
- if any restricted wastes are visibly present; and
- if the waste appearance matches any previously noted descriptions.

It is standard procedure to check manifests and inspect shipments visually regardless of the waste. Additional sampling and analysis of wastes are more dependent on the specific generator and the waste. All of the waste shipments will be sampled as described in Section 5, "Waste Sampling and Analysis," but the analysis of waste shipments does not always include measuring all the parameters used in the initial waste characterization. A subset of these, known as "key parameters," is selected, so we can obtain the best indication of waste identity and incinerability, within reasonable given time and labor constraints. Four criteria are considered when selecting key parameters. These are --

- the need to identify restricted wastes,
- waste characteristics that affect the incinerator's performance,
- the potential ignitability, reactivity, or incompatibility of the wastes, and
- parameters that best indicate changes in waste characteristics.

We feel assured that we can adequately screen incoming shipments by basing our key parameters on these criteria.

In the event that a waste shipment does not pass the screening tests, we contact the generator and, if requested, we perform a complete recharacterization, analyzing for all the parameters previously selected and any additional parameters that may be necessary. Based on these results, we will accept or reject the waste shipment.

If we are notified by one of our generators or we suspect that a waste generating process or its operation has changed, we will analyze the waste to see if its character has changed. We will obtain as much information about the change as the generator can provide, receive the generator's approval to take an unscheduled sample, and then completely characterize it. We will evaluate the characterization results to decide if the waste meets the permit envelope of parameter limits when blended for waste feed. If it does not, we will reject the waste.

5. Waste Sampling and Analysis

Sampling

The sampling procedures are based on the wastes' physical/chemical properties and means of containment. We selected the appropriate representative sampling techniques, devices, and containers from "Test Methods for Evaluating Solid Wastes" (SW-846). The equipment selected is listed for handling material of the same physical form as our waste. Scientific literature and work history volunteered by the generators were also reviewed to identify any needs for special waste handling procedures necessary to protect our personnel and keep our samples representative. Based on this review, we will be certain that the sampling personnel wear goggles, rubber gloves, and aprons; that the area is well-ventilated when sampling; and that personnel are fully aware that certain wastes are toxic.

Since the still bottoms will be delivered in tanker trucks, we will screen each shipment by taking grab samples through the tank access ports. A vertical sample will be taken at each port so as to obtain as representative a sample as possible across the depth of the tank, considering the limited access. Long glass tubing (SW-846, 1.4.1)(decontaminated between samples) will be used to obtain full vertical samples. Sampling with this tube will be based on the same principle as sampling shallow depths with Coliwasas. The ASTM Method D140-70 describes the tube sampling method. Waste samples will be stored in glass bottles with teflon caps (SW-846, 1.2.2).

The same sampling approach is used for routine waste characterization and recharacterization and for unscheduled sampling of the wastes.

Quality assurance and quality control procedures for waste sampling are described in Appendix I.

Analysis

Table 2 identifies the test methods chosen to characterize and periodically recharacterize the wastes and our rationale for selecting each parameter. Key parameters selected to screen the wastes in each shipment are also identified. All analyses will be performed in-house, and all the analytical methods are EPA-approved. Quality assurance and quality control procedures for waste analysis are discussed in Appendix I.

The frequencies of recharacterization are as follows: 1) streams A-1 and A-2 -semiannual, 2) stream B-1 -annual, and 3) stream C-1 -quarterly. They were selected based on a ranking exercise that considers the issues addressed in Section 4. [See Appendix E of this manual for an explanation of this ranking exercise.]

TABLE 2. WASTE ANALYSIS INFORMATION

Stream[1]	Parameters[2]	Analytical Methods[3]	Rationale for Parameters
All Streams	*Specific gravity	ASTM D891, Method C (Specific Gravity Balance)	Waste verification.
All Streams	Viscosity	ASTM D2170 (Kinematic Viscometer)	Waste verification and assessment of waste delivery system's adequacy.
All Streams	*Water content	ASTM D95 (Distillation)	Assess burning efficiency and, in turn, air requirements.
All Streams	Total organic carbon	APHA 505 (Combustion-Infrared - Detection Limit = 1 mg/L)	Burning efficiency. Waste verfication.
All Streams	*Heat of combustion	ASTM D240 (Bomb Calorimeter)(or 2015 (Adiabatic Calorimeter))	Assess burning efficiency.
All Streams	Ash content	APHA 209E (Total Volatile and Fixed Residue at 550°C)	Maintain compliance with particulate emissions standards; evaluate slag formation, and assess if system's ash handling capacity is sufficient.
All streams	Corrosivity	SW-846, Method 1110 (Corrosivity Toward Steel)	Identification of corrosives for safe handling.

TABLE 2. (continued)

Stream[1]	Parameters[2]	Analytical Methods[3]	Rationale for Parameters
All streams	*Flashpoint	SW-846 1010 (Pensky-Martens Closed Cup)	Waste verification. Identification of ignitables for safe handling.
All streams	Reactivity	U.S. Gap Test or U.S. Internal Ignition Test[4]	Identification of explosives for safe handling.
All streams	*Organochloride content (shipment analysis of B-1 is not performed.)	SW-846, Method 9020 (Microcoulometric Titration).	Maintain compliance with chloride emissions standards via hydrogen chloride removal system.
All streams	Volatile and semivolatile organic constituents.	SW-846, Methods 8240 and 8250, respectively (GC/MS; detection limits vary based on constituent)	Identify any hazardous organic constituents that are present to determine if Btu values exceed methylene chloride's.
A-1, C-1	Methylene chloride	SW-846, Method 8010 (GC)	Verify toxic constituent. Monitor destruction and removal.
A-2	Trichloroethylene	SW-846, Method 8010 (GC Detection Limit = 0.02 μg/L)	Verify toxic constituent. Monitor destruction and removal.
B-1	Acetone	SW-846, Method 8015 (GC Detection Limit = 1 μg/L)	Verify ignitable constituent.

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[1] Recharacterization Frequency: A-1 and A-2 - semiannual; B-1 - annual; C-1 quarterly.

[2] Asterisk denotes key parameters measured with each shipment.

[3] APHA - American Public Health Association's Standard Methods for the Examination of Water and Wastewater 1980.
ASTM - American Society for Testing and Materials.
SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

[4] [Author's note: These explosivity tests are currently under development by the Bureau of Mines for EPA.]

A waste will be rejected if recharacterization analyses indicate it does not fall within our permit specifications.

We have chosen to analyze discrete waste streams for the parameters in Table 2 rather than analyze the waste feed. Since our waste recharacterizations and shipment screenings involve the analysis of discrete waste streams, we plan to use these test results to characterize the waste feed rather than repeat those tests again. Waste feed properties will be estimated based on the volumes of waste streams blended together. The waste feed will be sampled and measured for heating value once a week to ensure that it remains under the heating value maximum and, in turn, prevents damage to the refractory materials.

APPENDIX I

Quality Assurance/Quality Control Program

Program Goal

Our program's goal is to obtain accurate and precise waste data so that we can assure that the wastes we incinerate possess the chemical/physical properties specified in our permit. We accomplish this by making sure that --

- the wastes meet the predetermined characteristics, and
- no restricted wastes are accepted.

We generate a great deal of data at the facility. Therefore, we carry out the quality assurance/quality control program to the fullest to assure that accurate and precise data are obtained.

Sampling Program

Designated personnel have been trained to sample waste shipments. This Part B application contains a chapter on their training program. Our operations manager evaluates the employees' sampling skills quarterly. Sampling equipment is inspected for decontamination and operability before each shipment is sampled. Each inspection is documented, noting any problems and corrective actions taken.

Since our facility handles more than one waste and one generator, all sample containers are labeled (see Figure I-1), and vital sampling information is logged in the field (see Figure I-2) before another employee drives the samples and an accompanying list of those samples to the laboratory for analysis.

Analysis Program

Our laboratory personnel have been trained to perform the analytical procedures outlined in Table 2. This Part B application contains a description of their training program. The employees' analytical skills are checked with blanks or standards that are included in each analysis.

Lab personnel document the receipt of each sample. Waste samples are stored according to their expected content until analysis. Screening samples are analyzed as soon as possible to avoid delays in shipment processing. Characterization/recharacterization samples are analyzed depending on their storage life. Sample identification numbers are assigned to the replicates that are analyzed. The quality assurance/quality control procedures for analysis follow those outlined in each test method of SW-846, "Test Methods for Evaluating Solid Waste," or other EPA-approved methods.

Collector R. Hunt Sample No. A-2-FT-1

Place of Collection Tanker truck - receiving area. Sample taken from top (FT) port.

Date Sampled August 29, 1983 Time Sampled 3:00 p.m.

Field Information Sample appeared as described in files. Rainy weather.

Figure I-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

Date 8/29/83
Time 3:00 p.m.

Sample Identification Number A-2-FT-1

1. Waste Identification

Still bottoms of spent trichloroethylene

2. Purpose of Sampling

Shipment screening

3. a. Sampling Point Location
   b. Description Front top port of tanker
   Tube grab sample taken across the vertical depth of the tank.

4. a. Number of Samples Taken b. Volume per Sample

One sample for front top port one gallon

5. Any Field Measurements Taken No

Parameter Measurement

6. Observations During Sampling

Sample appeared as described in files. Rainy weather.

7. a. Sample Destination b. Means of Transport

Onsite laboratory Truck

Signature of Sampling Person: R. Hunt

Figure I-2. Field log.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

All test results are documented on the characterization form shown in Figure 1 and are kept on file in our facility's office.

Analytical equipment is inspected and serviced semiannually in addition to routine checks before each analysis. Leftover samples are returned to storage for incineration.

MODEL WASTE ANALYSIS PLAN

CHEMICAL TREATMENT

1. Facility Description

The Chemical Treatment Company is requesting a RCRA permit to operate a commercial treatment facility that chemically stabilizes hazardous wastes received from offsite generators. This permit would allow us to treat hazardous wastes consisting of solid organics, oxidizers, and metals. We specifically plan to treat--

- segregated cadmium wastewater treatment sludge,
- pigment wastewater treatment sludge,
- emission control dust/sludge from secondary lead smelting,
- emission control dust/sludge from the primary production of steel in electric furnaces, and
- cumene distillation bottom tars.

All of the wastes we treat must have the characteristics of one of these wastes.

The treatment process entails chemically fixing the wastes in cement. This will produce a stable, solidified waste that is sent offsite for disposal. The process is designed specfically to treat solid organics, oxidizers, and metal-based wastes safely and effectively. Another portion of this Part B application contains a detailed description of our facility's design and the results of the trial treatment test.

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[1] A facility such as this may have onsite hazardous waste storage. This model will not address storage since it is addressed in another model. A real waste analysis plan would be required to describe the facility's storage practices.

2. Identification of Wastes to be Treated

Table 1 contains all the pertinent characteristics of each waste stream to be treated onsite. Any other waste types will be restricted from the facility.

Our staff sampled and analyzed each waste for its initial characterization. This entailed collecting four sets of samples at 3-week intervals. The results of the sample analyses are summarized in Table 1. Specific data sheets are available upon request. (Quality assurance and quality control programs for sampling and analysis are described in the appendix.) This characterization was intended to determine that the wastes fell within the categories planned for treatment. Figure 1 is an example of the waste characterization form completed for each waste. Four generators provided their waste analysis data from past years to support our results. The fifth facility is relatively new, so they obtained data from a similar facility with 14 years of operating experience to support their waste data.

The waste stream boundary conditions are the maximum and minimum values of waste characteristics that the facility can treat properly. We have selected boundary conditions of plus or minus the following percentages of the limits found in Table 1:

- segregated cadmium wastewater treatment sludge ± 10%,
- pigment filter cake ± 5%,
- emission control dust/sludge from secondary lead smelting ± 15%,
- emission control dust/sludge from the primary production of steel in electric furnaces ± 10%, and
- cumene distillation bottom tars ± 20%.

For example, pigment filter cake boundary conditions for pH would be 5 percent less than 7.0 (i.e., 6.65) and 5 percent more than 9.5 (i.e., 9.98). These conditions were set following our waste analyses and talks with generators about the consistency of their wastes. The wastes are not expected to fall outside these limits; however, if they do, we will follow the contingency procedures described in Section 4, "Parameters to be Monitored."

TABLE 1. WASTE CHARACTERISTICS[1]

	Stream	Basis for Hazard Listing	Physical Properties	Chemical Composition (or % by volume)
1.	Segregated Cadmium Wastewater Treatment Sludge (RCRA No.[2] F006)	Cadmium, Hexavalent Chromium, and Complexed Cyanide (Toxic [T])	Specific gravity:[4]	pH: 7.0 to 9.5 Complexed cyanide: negligible Cadmium: 17,000 to 22,000 ppm Total Chromium: 50,000 to 62,000 ppm
2.	Pigment Filter Cake (RCRA Nos.[3])	K002- Hexavalent Chromium and Lead (T) K003- Hexavalent Chromium and Lead (T) K004- Hexavalent Chromium (T) K005- Hexavalent Chromium and Lead (T)	Specific gravity:[4]	pH: 9.0 to 12.0 Total Chromium: 50 to 100 ppm Lead: 20 to 70 ppm
3.	Emission Control Dust/Sludge from Secondary Lead Smelting (RCRA No.[3] K069)	Hexavalent Chromium, Cadmium, and Lead (T)	Specific gravity:[4]	pH:[4] Cadmium: 300 to 520 ppm Lead: 45,000 to 60,000 ppm Total Chromium: 25 to 40 ppm
4.	Emission Control Dust/Sludge from the Primary Production of Steel in Electric Furnaces (RCRA No.[3] K061)	Hexavalent Chromium, Cadmium, and Lead (T)	Specific gravity:[4]	pH:[4] Cadmium: 600 to 700 ppm Lead: 1,250 to 1,400 ppm Total Chromium: 10,300 to 17,600
5.	Cumene Distillation Bottom Tars (RCRA No.[3] K022)	Phenol and Tars (polycyclic aromatic hydrocarbons [PAH]) (T)	Flash Points: 90 to 100° C Specific gravity:[4]	Phenol: 0.7 to 1.5% by weight PAH: 0.8 to 1.7% by weight

[1] Process code for all streams is T01, chemical treatment.
[2] Refer to 40 CFR 261.31.
[3] Refer to 40 CFR 261.32.
[4] [Author's note: Insufficient information available for these specific wastes for this model.]

Date ______________

1. Generator

   a. Name

   b. Address

   c. EPA ID Number __________

2. Waste Identification

   a. Facility Waste Number ________ Sample Number ____

   b. RCRA Waste Number ________

   c. DOT Waste Number ________

   d. Name of Waste

   e. General Description of Waste Generation Process

3. Sampling

   a. Date Sampled b. Sampling Method

   c. Name and Affiliation of Sampler

   d. Was sample taken during normal process operation? ____ Yes ____ No

4. Physical State (21° C (70° F)) ____ Solid ____ Sludge ____ Liquid

5. Specific Gravity

6. Corrosive ____ Yes ____ No pH (regardless of corrosivity) ____

7. Ignitable ____ Yes ____ No Flash Point _____ °C ______ °F

   Test Method

Figure 1. Waste characterization form.

8. Reactive _____ Yes _____ No Test Method

Description of Results

9. EP Toxic Metals _____ Yes _____ No

Contaminant	Concentration	Method of Analysis

10. Organic Components (Indicate percent by weight or mg/L) Test Method

11. Inorganic Components (Indicate percent by weight or mg/L) Test Method

I hereby certify the accuracy of these data and the representativeness of the waste sample.

Signature and Title ______________________________

Date ______________________________

Figure 1. Waste characterization form (continued).

3. Chemical Treatment Tolerance Limits

The treatment process is limited in that it cannot stabilize as effectively wastes that may contain 1) soluble salts of zinc, copper, or lead; 2) sodium salts or other salts of arsenate, borate, phosphate, iodate, or sulfide; or 3) large quantities of sulfates because these constituents retard cement setting time.

The process requires that the influent waste or waste mixture have a pH between 8 and 12. If necessary, additives will be blended in to achieve this pH.

We do plan to accept wastes that may be incompatible with other wastes we manage. Since the process cannot treat incompatible wastes together, they are treated in separate batches and the structure is decontaminated between batches.

4. Waste Parameters to be Monitored

Waste analysis parameters were selected after 1) reviewing existing information on the waste properties, for example, 40 CFR 261 Appendix VII (including a search for ignitability and reactivity), 2) noting what properties best indicate any change in a waste, and 3) comparing this information to our treatment facility's design criteria and trial treatment test results so that we can prevent any noncompliance with RCRA permit conditions.

The treatment structure's materials of construction were chosen for their compatibility to the specific waste categories listed in Section 2; therefore, this aspect of compatibility is not a factor. Design information about the treatment structure can be found in another chapter of this Part B application.

Since the permit will be based on the type of waste the process can treat, we chose waste analysis parameters based primarily on waste characteristics and those properties that are indicative of treatment performance. These include pH, specific gravity, EP toxic metals, total and amenable cyanide, flash point, reactivity, phenol, and PAH. For those nonhazardous constituents listed in Section 3 that retard the setting of cement, we have chosen to conduct cement setting tests on small samples of waste. Conducting tests to measure the specific constituents would be quite lengthy and may not be accurate. Waste-to-waste compatibility tests will be conducted also. Waste compatibility to treatment reagents and treatment structures has already been demonstrated.

We plan to completely recharacterize the wastes periodically. This will verify that the shipment screenings are correct and identify any waste changes that cannot be verified by simple screening.

We selected the recharacterization frequencies by considering --

- the potential for restricted wastes to be combined in a shipment,
- the variability of the waste composition between shipments,
- the likelihood that a waste will undergo changes that would alter its permitted characteristics, and
- the performance history and reliability of the waste generator.

Section 5, "Waste Sampling and Analysis," lists the analysis procedures, provides a rationale for each analysis parameter selected, and identifies the frequencies of waste recharacterization.

All incoming waste shipments will be screened following those steps displayed in Figure 2. The screening procedures are based on our generators, the wastes they plan to ship, and applicable RCRA regulations.

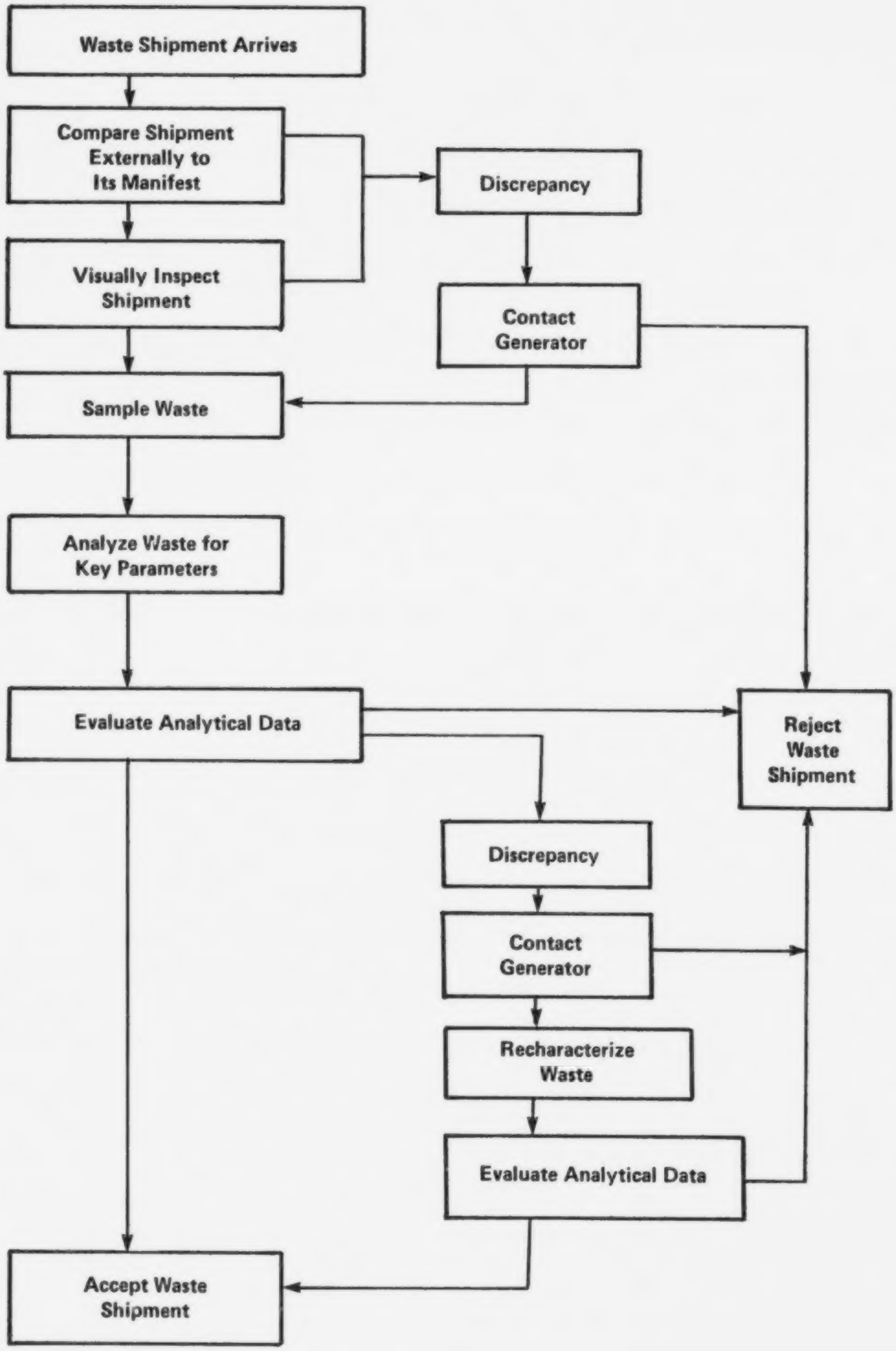
Waste Shipment Arrives
Compare Shipment Externally to Its Manifest
Discrepancy
Visually Inspect Shipment
Contact Generator
Sample Waste
Analyze Waste for Key Parameters
Evaluate Analytical Data
Reject Waste Shipment
Discrepancy
Contact Generator
Recharacterize Waste
Evaluate Analytical Data
Accept Waste Shipment

Figure 2. Shipment screening procedures.

When a waste shipment arrives at our facility, we check its manifest for completeness and correctness. At a minimum, we will look for the following information on each manifest:

- a manifest document number;
- the generator's name, address, and EPA identification number;
- each transporter's name and EPA identification number;
- the destination of the waste shipment, i.e., hazardous waste management facility, address, and EPA identification number;
- an alternative hazardous waste management facility, address, and EPA identification number;
- a Department of Transportation shipping name and number;
- the quantity or volume of waste in the shipment;
- the number and type of containers in the shipment (if applicable); and
- a signed, dated certification of the shipment's content.

We will then visually inspect the shipment, noting --

- if the number and type of containers match the manifest;
- if the shipment labels/placards match the manifest;
- the presence of free liquids and the consistency with the manifest;
- any irregularities with the shipment, e.g., leaks;
- if any restricted wastes are visibly present; and
- if the waste appearance matches any previously noted description.

Each waste shipment that passes initial inspection will be sampled and analyzed. We sample all waste shipments as described in Section 5, "Waste Sampling and Analysis," but the analysis of waste shipments does not always include measuring all the parameters used in our initial waste characterization. Rather, we select a subset of these to measure known as "key parameters," so we can 1) obtain the best indication of waste treatability within given time and labor constraints, and 2) identify any ignitable, reactive, or incompatible wastes that may be present. The key parameters are selected based on --

- the need to identify any restricted wastes,

- waste characteristics that affect treatment process performance,
- the ignitability, reactivity, or incompatibility of the wastes, and
- those parameters that best indicate waste characteristic changes.

Figure 2 also shows the analytical procedures followed when a shipment screening indicates that a waste does not agree with the characteristics of our permitted wastes. In such an event, we contact the generator and, if agreed, we perform a complete recharacterization (with the generator's approval), analyzing for all the parameters previously selected and any additional parameters that may be necessary. Based on these results, we will accept or reject the waste shipment.

If we are ever notified by one of our generators or suspect that the waste generating process or its means of operation has changed, we will check to see if the waste has changed in character. We will obtain as much information about the change as the generator can provide and receive the generator's approval to take an unscheduled sample and completely characterize it. The characterization results will be evaluated to decide if the waste complies with those waste characteristics that the treatment process is permitted to handle. If it does not, we will reject the waste.

5. Waste Sampling and Analysis

Sampling

Table 2 lists representative sampling techniques selected for each waste we plan to manage. Specific waste streams are listed because their means of containment varies from one generator to another.

The sampling procedures were developed by first identifying the wastes' physical/chemical properties and means of containment, e.g., tanker truck. We selected the appropriate representative sampling techniques, sampling devices, and sample containers following a review of "Test Methods for Evaluating Solid Waste" (SW-846). Since the equipment selected is listed for handling materials of the same physical forms as our wastes, we believe that the equipment is suitable.

We reviewed the scientific literature and work history volunteered by the generators to identify any needs for special waste handling during sampling. Such information helps protect our personnel and keeps our samples representative.

We will use simple random sampling for wastes arriving in 55-gallon drums. These wastes are homogeneous and can be grab sampled at mid-level in the drum through the bung opening. Simple random sampling entails using a random numbers table to select drums to sample [see Appendix C of this manual]. The number of drums sampled is based on the American Society for Testing and Materials (ASTM) cube root equation for barrels [see Appendix D of this manual].

Tanker trucks will be sampled through access ports in the tanks. Since our access is limited to ports, which may limit the representativeness of the sample, we will take samples at three discrete vertical depths to provide the best representation of waste possible.

We sample closed-bed trucks through access ports in the trailer. A vertical sample that covers the depth of the bed is taken. Thus, our access is limited and the representativeness of the waste sample may also be limited.

The sampling approaches described above pertain to characterization and recharacterization sampling as well as unscheduled sampling of the wastes.

Quality assurance and quality control procedures for sampling wastes are described in the appendix.

Analysis

Table 3 identifies the parameters and their analytical methods chosen to characterize wastes periodically as well as a subset of key parameters chosen to screen the wastes in each shipment. Table 3 also provides our rationale

TABLE 2. WASTE SAMPLING INFORMATION

Stream Numbers	Containment Device	Sampling Technique	Number of Samples Taken	Comments	References
1.,3., and 4. (single layered sludges)	Tanker truck	Access limited to tank ports. Grab sample with weighted bottle.	Grab samples at top, middle, and bottom of tank.	1. Do not composite sample. 2. Wear goggles, rubber gloves, protective clothing, respirator, and face shield. 3. Store sample away from acids and standing water. 4. TOXIC WASTE.	Technique: SW-846,[1] Section 1.4.1 Device: SW-846, Section 1.2.1.5
2.	Closed bed truck	Access limited to ports. Grab sample with trier.	One vertical core sample through bung across depth of drum.	1. Do not composite samples. 2. Wear rubber gloves, apron, mask, and breathing appartus. 3. Place sample in linear polyethylene container. 4. TOXIC WASTE.	Technique: SW-846, Section 1.4.1 Device: SW-846, Section 1.2.1.5

TABLE 2. (continued)

Stream Numbers	Containment Device	Sampling Technique	Number of Samples Taken	Comments	References
5.	55-gallon drums	Simple random sampling. Grab sample with trier.	$\sqrt[3]{\text{No. of drums in shipment}}$[2]	1. Store in a cool, well-ventilated area. 2. Wear goggles, breathing mask, gloves, apron, and boots. 3. Place sample in linear polyethylene container. 4. Use Teflon® cap. 5. Get sample through bung across depth of drum. 6. TOXIC WASTE.	Technique: SW-846, Section 1.1.3.1 Device: SW-846, Section 1.2.1.5

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[1] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.

[2] Source of cube root equation: American Society for Testing and Materials, Method D 140-70.

TABLE 3. WASTE ANALYSIS INFORMATION

Stream Number^1	Parameters^2	Analytical Methods^3	Rationale for Parameters	Detection Limit (μg/L)
1., 2., 3., 4.	*Reactivity	U.S. Gap Test or U.S. Internal Ignition Test 4	Identify reactive wastes for safe handling.	-
1.	*Total and amenable cyanide	SW-846, Method 9010 (Titration)	Verify no cyanide reactivity.	-
1., 2., 3., 4.	*pH	SW-846, Method 9040 (pH Meter)	Assure within pH treatability range.	-
1., 2., 3., 4.	*Specific gravity	ASTM D1429, Method C (Erlenmeyer Flask)	Waste verification.	-
1., 2., 3., 4.	Arsenic	SW-846, Method 7061 (AA)	Identify unexpected metals.	2
1., 2., 3., 4.	Barium	SW-846, Methods 3050/7080 (AA)	Identify unexpected metals.	400
1., 2., 3., 4.	Cadmium	SW-846, Methods 3050/7130(AA)	Measure treatment performance.	5
1., 2., 3., 4.	Total chromium	SW-846, Methods 3050/7190(AA)	Measure treatment performance.	50
1., 2., 3., 4.	Lead	SW-846, Methods 3050/7420(AA)	Measure treatment performance.	100

TABLE 3. (continued)

Stream Number[1]	Parameters	Analytical Methods	Rationale for Parameters	Detection Limit (µg/L)
1., 2., 3., 4.	Mercury	SW-846, Method 7471 (cold vapor technique)	Identify unexpected metals.	0.2
1., 2., 3., 4.	Selenium	SW-846, Method 7741 (AA)	Identify unexpected metals.	2
1., 2., 3., 4.	Silver	SW-846, Methods 3050/ 7760 (AA)	Identify unexpected metals.	10
5.	*Flash point	SW-846, Method 1010	Verify waste.	-
5.	Phenol	SW-846, Method 8040 (Gas Chromatograph)	Verify waste and measure treatment performance.	1.4
5.	PAH	SW-846, Method 8100 (Gas Chromatograph)	Verify waste and measure treatment performance.	-
1., 2., 3., 4., 5.	*Cement setting retardants	Needle penetration test (COE)	Identify the presence of constituents that retard setting.	-
1., 2., 3., 4., 5.	*Waste compatibility	Mix wastes proportional to treatment mixture[5]	Identify incompatible wastes.	-

---

[1] Recharacterization Frequency: Stream 1.- semiannual; 2.- annual; 3.- quarterly; 4.- annual.

[2] Asterisk denotes key parameters measured with each shipment.

[3] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.
ASTM American Society for Testing and Materials.
COE Corps of Engineers

[4] [Author's note: These explosivity test methods are currently under development by the Bureau of Mines for EPA.]

[5] [Author's note: An actual waste analysis plan would provide a description of the test method.]

for selecting each parameter. All analyses will be performed in-house. Quality assurance and quality control procedures for waste analysis are described in the appendix.

The frequencies of recharacterization selected are also found in Table 3. They were based on a ranking exercise that considers the issues addressed in Section 4. [See Appendix E of this manual for an explanation of this ranking exercise.] The details of the ranking exercise are not included since they take the waste generators' performance history into consideration. However, the details are available upon request.

Should recharacterization analysis prove that the waste is not manageable by our treatment process within the specified permit conditions, we will reject it.

APPENDIX

Quality Assurance/Quality Control Program

Program Goal

Our program's goal is to assure that we acquire accurate and precise information in order to assure that the wastes we treat exhibit those chemical/physical characteristics for which our process is permitted. We accomplish this by making sure that --

- the wastes are the permitted organic solids, oxidizers, or metal-based wastes;
- waste incompatibilities are identified so that they are treated in separate batches; and
- no restricted wastes are accepted.

We generate a great deal of data at our facility. Thus, we carry out our quality assurance/quality control program to the fullest to assure that accurate and precise data are obtained.

Sampling Program

Two of our employees have been trained to sample waste shipments. This Part B application contains a chapter on their training program. The employees' sampling skills are observed quarterly by our operations manager. Sampling equipment is inspected for decontamination and operability before each shipment is sampled, and each inspection is documented, noting any problems and corrective actions taken.

Since we plan to handle more than one waste and one generator at the facility, all sample containers will be labeled (see Figure A-1), and vital sampling information will be logged in the field (see Figure A-2) before a designated driver carries the samples (with an accompanying list of those samples) to the laboratory.

Analysis Program

Our laboratory personnel have been trained to perform the analytical methods outlined in Table 3. This Part B application contains a description of their training program. The employees' analytical skills are checked with blanks or standards that are included in each set of analyses.

Collector C. Carter Sample No. 3-2

Place of Collection Tanker truck receiving area.

Date Sampled March 8, 1983 Time Sampled 11:06 a.m.

Field Information Sample taken from rear access port mid-level. Sample appears typical.

Figure A-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes," SW-846, July 1982.

Date 3/8/83
Time 11:06 a.m.

Sample Identification Number 3-2

1. Waste Identification
   - a. Waste Type Emission control dust/sludge from secondary lead smelting
   - b. Facility Waste Number 3
   - c. Suspected Composition Sludge with cadmium, lead, and hexavalent chromium

2. a. Waste Generator Lead Smelters, Inc.
   Address
   Leadville, USA

   b. Generation Process
   Secondary lead smelting - air pollution control devices

3. Purpose of Sampling

   Incoming shipment inspection

4. a. Sampling Point Location Tanker truck
   b. Description
   Sample taken from rear access port mid-level

5. a. Number of Samples Taken

   One

   b. Volume per Sample

   One liter

6. Any Field Measurements Taken No

   Parameter

   Measurement

7. Observations During Sampling Sample appears typical

8. a. Sample Destination

   In-house laboratory

   b. Means of Transport

   Van

Signature of Sampling Person: C. Carter

Figure A-2. Field log.

Source: "Test Methods for Evaluating Solid Wastes," SW-846.

Lab personnel document the receipt of each sample. Waste samples are stored until analysis according to their expected content. Screening samples are analyzed as soon as possible (less than 24 hours) to avoid delays in shipment processing. Characterization/recharacterization samples are analyzed depending on their storage life. Sample identification numbers are assigned to the replicates analyzed. The quality assurance/quality control procedures for analysis follow those outlined in each test method of SW-846, "Test Methods for Evaluating Solid Waste," or other EPA-approved methods.

All test results are documented on the characterization form shown in Figure 1 and kept on file in the facility office.

Analytical equipment is inspected and serviced semiannually in addition to routine checks before each analysis. Leftover waste samples will be returned to the appropriate storage container for later treatment.

MODEL WASTE ANALYSIS PLAN

LANDFILL

1. Facility Description

The Land Disposal Company owns and operates a commercial hazardous waste landfill facility, receiving wastes that are generated offsite. The facility is operating under a RCRA interim status permit. Today, we are requesting a permit to operate under current RCRA landfill standards (40 CFR 264 Subpart N).

The landfill receives organic and inorganic solid and sludge wastes (no liquid wastes); however, some of these wastes are restricted from disposal (see Section 2). No wastes containing free liquids and no wastes containing greater than 70 percent water are accepted. The acceptable wastes require no treatment before disposal and are not stored onsite for greater than 90 days.

The landfill trenches are designed to contain these wastes safely, so no exposure to the surrounding environment occurs. (Another portion of this Part B permit application contains a detailed description of our facility's design.) The trenches contain synthetic liners and leachate collection systems whose materials were selected for their compatibility with the waste types we handle. The natural clay formation underlying our site also has a very low permeability to the wastes we receive (see the Facility Design and Hydrogeology chapters).

2. Identification of Wastes to be Landfilled

Table 1 lists the pertinent characteristics of each hazardous waste for which we are requesting a RCRA permit, i.e., the wastes we currently manage at the landfill facility. The analytical data on off-spec lead acetate were provided by the generator. Our staff sampled and analyzed the two pigment filter cake waste streams five times (once every 2 weeks), resulting in the analytical data found in Table 1. The initial characterization data in Table 1 for the dust/sludge from secondary lead smelting were provided by the waste generator. The Land Disposal Company has confidence in these data because of the generator's work history and the knowledge that their process goal is to recover as much of the metals as possible. Our staff sampled and analyzed the bottom tar waste three times during a 6-week period to obtain the initial characterization data given in Table 1. A detailed display of all the data collected is presented in Appendix III. [This model does not include Appendix III due to the lack of representative data. However, an actual plan could include such data.] Quality assurance and quality control programs for sampling and analysis are described in the appendix.

The Land Disposal Company conducted the initial characterization of each waste to ensure that no restricted wastes were present and to verify the waste composition. Compatibility among wastes was also considered.

Figure 1 is an example of the waste characterization form we complete for each waste. All of the wastes currently managed are mutually compatible. Therefore, we see no need to test routinely for compatibility.

Waste stream boundary conditions of ± 10 percent of the waste characteristic limits shown in Table 1 have been designated. These boundary conditions have been set to identify anomalies in waste characteristics. This helps alert us to any unusual properties that may require our attention. We selected 10 percent after reviewing our waste analyses and analytical data from each generator. The contingency procedures discussed in Section 4, "Waste Parameters to be Monitored," will be followed if boundary conditions are exceeded.

The Land Disposal Company restricts the following wastes from the site:

free liquids
gaseous wastes
oxidizers
cyanides
sulfides
ignitable wastes
reactive wastes
corrosive wastes
radioactive wastes
polychlorinated biphenyls

The landfill trenches are not designed to retain these wastes chemically or physically. We do have the capability of accepting certain incompatible wastes. We would safely dispose of these incompatible wastes by isolating them in clay cells within the trenches.

TABLE 1. WASTE CHARACTERISTICS

	Stream[1,2]	Basis for Hazard Classification	Physical State	Chemical Composition
A-1	Off-spec lead acetate (RCRA No. U144)[3]	Lead acetate (Toxic)	Solid, single layer Density = 3.25 g/ml	Lead acetate: up to 95% by weight
A-2	Pigment filter cake (RCRA No. K003)[4]	Lead, hexavalent chromium (Toxic)	Sludge, single layer	Lead: 50 to 200 ppm Total chromium: 20 to 80 ppm Water: 40 to 70% by weight pH: 8.5 to 11.0
B-1	Pigment filter cake (RCRA No. K004)[4]	Hexavalent chromium (Toxic)	Sludge, single layer	Total chromium: 50 to 100 ppm Water: 50 to 70% by weight pH: 9.5 to 11.0
C-1	Dust/sludge from secondary lead smelting (RCRA No. K069)[4]	Hexavalent chromium, lead, cadmium (Toxic)	Sludge, single layer	Cadmium: 200 to 300 ppm Lead: 35,000 to 50,000 ppm pH: 5.0 to 7.0 Water: 30% by weight Total chromium: 10 to 30 ppm
D-1	Bottom tars from phenol production (RCRA No. K022)[4]	Phenol, Tars (polycyclic aromatic hydrocarbons [PAH])	Tarry solid, single layer	Phenol: 0.7 to 1.5% by weight PAH: 0.8 to 1.7% by weight Flash point: 90 to 100 °C Water: 0.5 to 2.0% by weight

---

[1] Stream numbers indicate generator (A, B, C, and D) as well as separate streams from each waste generator.

[2] Process code for all streams is D80, Landfill.

[3] 40 CFR, Part 261.32.

[4] 40 CFR, Part 261.33.

Date ______________

1. Generator

   a. Name

   b. Address

   c. EPA ID Number ____________

2. Waste Identification

   a. Facility Waste Number __________ Sample Number _____

   b. RCRA Waste Number __________

   c. DOT Waste Number _________

   d. Name of Waste

   e. General Description of Waste Generation Process

3. Sampling

   a. Date Sampled b. Sampling Method

   c. Name and Affiliation of Sampler

   d. Was sample taken during normal process operation? ____ Yes ____ No

4. Physical State at 21° C (70° F) _____ Solid _____ Sludge _____ Liquid

5. Water Content (percent) Test Method

6. Corrosive _____ Yes _____ No pH (regardless of corrosivity) _____

7. Ignitable _____ Yes _____ No Flash Point ______° C _______° F

   Test Method

Figure 1. Waste characterization form.

---

8. Reactive _____ Yes _____ No   Test Method

Description of Results

9. EP Toxic Metals _____Yes _____ No

Contaminant	Concentration	Method of Analysis

10. Other Restricted Wastes Test Methods

Free Liquids	_____	Yes	_____	No
Gaseous Wastes	_____	Yes	_____	No
Oxidizers	_____	Yes	_____	No
Cyanides	_____	Yes	_____	No
Sulfides	_____	Yes	_____	No
Radioactives	_____	Yes	_____	No
Polychlorinated biphenyls	_____	Yes	_____	No

11. Organic Components (Indicate percent by weight or mg/L including phenol and polycyclic aromatic hydrobarbons (PAH) for organic waste streams

Test Methods

I certify the accuracy of these data and the representativeness of the waste sample.

Signature and Title ______________________________

Date ________________

Figure 1. Waste characterization form (continued).

3. Landfill Tolerance Limits

Sludges to be landfilled must not contain more than 70 percent water. [Note: This is an arbitrary value selected for this model.] The remainder of the sludge must be solids to assure minimal leachate generation. Also, the wastes must not contain any free liquids.

Tolerance limits are established to assure optimum landfill performance. They reflect those waste properties beyond which the landfill cannot safely contain each waste. In this case, water content and the presence of free liquids are the central factors in establishing tolerance limits.

4. Waste Parameters to be Monitored

The wastes managed at the facility must have characteristics that fall within the chemical or physical retention capabilities of the landfill, i.e., those characteristics to be specified in the RCRA permit. To select our analytical parameters, we 1) reviewed existing information on the waste properties including the EPA background information document (BID's) on each waste (including a search for ignitability, reactivity, and incompatibility), 2) noted what properties best indicate any change in a waste, and 3) compared this information to our landfill facility's design criteria.

Except for the off-spec lead acetate, waste streams are tested for a variety of parameters depending on their potential effects on the landfill and basis for hazard designation. These include free liquids, pH, cyanide, sulfide, oxidizing agents, reactivity, radioactivity, PCBs, and flash point, which are measured to detect restricted wastes. Analysis for water content, EP toxic metals, phenol, PAH, and a GC/MS scan for volatile and semivolatile organic constituents are conducted to verify waste characteristics and identify any potential liner-damaging organics that are present.

We decided how often to recharacterize the waste with these tests by considering --

- the potential for restricted wastes being combined in a shipment,
- the landfill's limitations,
- the variability of a waste's composition from one shipment to another,
- the likelihood of a waste undergoing changes that adversely affect its manageability, and
- the prior history of the waste generator performance and reliability.

Section 5, "Waste Sampling and Analysis," contains a description of these analysis procedures and identifies the frequencies of waste recharacterization for each stream.

We screen all incoming shipments to assure that the wastes we receive meet the permitted boundary conditions. The procedures followed during a shipment screening are presented in Figure 2.

We check each waste shipment manifest for completeness and correctness, looking for the following information on each manifest:

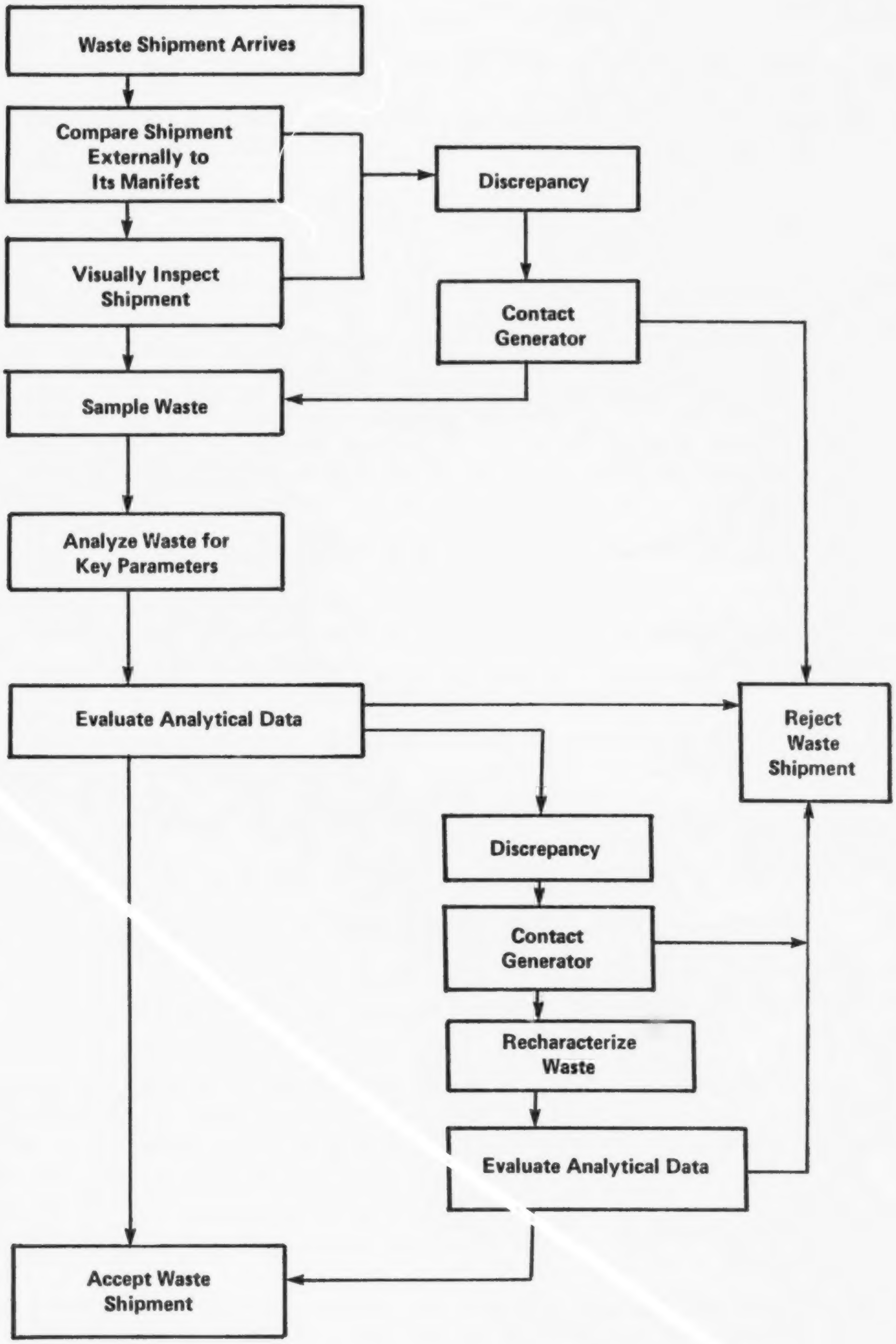
Waste Shipment Arrives
Compare Shipment Externally to Its Manifest
Discrepancy
Visually Inspect Shipment
Contact Generator
Sample Waste
Analyze Waste for Key Parameters
Evaluate Analytical Data
Reject Waste Shipment
Discrepancy
Contact Generator
Recharacterize Waste
Evaluate Analytical Data
Accept Waste Shipment

Figure 2. Waste shipment screening procedures.

- a manifest document number;
- the generator's name, address, and EPA identification number;
- each transporter's name and EPA identification number;
- the destination of the waste shipment, i.e., hazardous waste management facility, address, and EPA identification number;
- an alternative hazardous waste management facility, address, and EPA identification number;
- a Department of Transportation shipping name and number;
- the quantity/volume of waste in the shipment;
- the number and type of containers in the shipment (if applicable); and
- a signed, dated certification of the shipment's content.

We then visually inspect the shipment, noting --

- if the number and type of containers match the manifest;
- if the shipment labels/placards match the manifest;
- if the waste's appearance matches any previously noted descriptions;
- any irregularities with the shipment, e.g., leaks;
- if any restricted wastes are visibly present; and
- if each container is 90 percent full.

If any complications arise as a result of this inspection, we contact the generator to resolve the problem.

We sample and analyze each waste shipment (excluding off-spec commercial products[1]) that passes our initial inspection. The sampling procedures for each shipment depend on its means of containment, e.g., drums, when it arrives at our facility. Our analysis of waste shipments does not always include

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[1] We do not sample and analyze off-spec products as part of our screening procedures. The wastes are only off-spec and have never been contaminated by generator use. We rely on visual examination of off-spec products to identify them.

testing for all the parameters included in the initial waste characterization. Rather, we select a subset of these, designated "key parameters," so we can obtain the best indication of waste manageability within the given time and labor constraints. We consider four criteria when selecting key parameters. These are--

- the need to identify restricted wastes;
- waste characteristics that might affect the landfill's performance;
- the ignitability, reactivity, and/or incompatibility of the wastes; and
- those parameters that best indicate any changes in important waste characteristics.

A more detailed description of these procedures is found in Section 5, "Waste Sampling and Analysis."

If a shipment screening indicates that a waste has characteristics that are inconsistent with our acceptance criteria, we contact the generator and, if requested, perform a complete recharacterization, analyzing for all of the parameters previously selected and any additional parameters that may be necessary. Based on these results, we accept or reject the waste shipment.

If we are ever notified by one of the generators or suspect that the waste generating process or its means of operation has changed, we check to see if the waste has changed in character. We obtain as much information about the change as the generator can provide, and with the generator's approval, take an unscheduled sample and completely characterize it. We then evaluate the characterization results and decide if the landfill facility can continue to manage the waste safely within permit conditions. If not, we will reject it.

5. Waste Sampling and Analysis

Sampling

Sampling procedures were developed by first identifying the wastes' physical/chemical properties and means of containment. We selected the appropriate representative sampling techniques and sampling devices from "Test Methods for Evaluating Solid Wastes" (SW-846). Since the equipment selected is listed to handle material of the same physical form as our waste, we assume the equipment is suitable. Scientific literature and work histories volunteered by the generators were reviewed to identify any needs for special waste handling procedures to protect our personnel and keep the samples representative. Quality assurance/quality control procedures are addressed in the appendix.

Table 2 summarizes the representative sampling procedures selected for each waste stream. Specific waste streams are listed because their means of containment varies from one generator to another.

We use simple random sampling for wastes arriving in 55-gallon drums. The drummed wastes listed in Table 2 are homogeneous and can be grab sampled at mid-level in the drum. Simple random sampling entails using the random numbers table to select drums to sample. [See Appendix C of this manual.] The number of drums sampled is based on the American Society for Testing and Materials (ASTM) cube root equation for barrels. [See Appendix D of this manual.]

We sample closed-bed trucks through the access ports in the trailers. We take a vertical sample that covers the depth of the bed. Since access is limited, the representativeness of the waste sample is also limited.

We use random sampling for open-bed trucks where the sample areas are based on a three-dimensional grid. The volume of the load is divided into levels of imaginary cells based on the load length, width, and depth, and cell numbers are assigned in sequence. We then use the random numbers table to select the numbered cell to sample. [See Appendix C of this manual.] We next take one sample from the randomly chosen cell. Only one sample per truck is taken since the purpose of the sample is to verify that the waste is consistent with the manifest and does not contain more than 70 percent water.

Table 2 also lists "leachate" as a waste stream. Should any leachate be generated and collected in our trench sump, we obtain a grab sample near the bottom of the leachate's depth. Since we are limited to vertical sampling in the sump manhole, representative techniques are difficult to use.

We will take any unscheduled samples as described above, or we will develop any special procedures that are necessary to obtain representative samples on the generator's site.

TABLE 2. REPRESENTATIVE SAMPLING TECHNIQUES

Stream	Containment Device	Sampling Technique	Comments
A-1 Off-spec lead acetate[1]	55-gallon drum	Simple random grab sample with thief (SW-846, Section 1.2.1.4). Sample cube root of total number of containers per shipment.[2]	1. Wear rubber gloves, safety goggles, and a self-contained respirator. 2. Clean hands carefully. 3. Toxic. 4. Use glass container with teflon cap.
A-2 Pigment filter cake	Closed-bed truck	Vertical core sample through two ports with trier (SW-846, Section 1.2.1.5).	1. Wear rubber gloves, apron, shoes, mask, and breathing apparatus. 2. Use linear polyethylene sample container. 3. Toxic.
R-1 Pigment filter cake	Open-bed truck	Simple random grab sample with trier (SW-846, Section 1.2.1.5). One sample per depth level.	

TABLE 2. (continued)

	Stream	Containment Device	Sampling Technique	Comments
C-1	Dust/sludge secondary lead smelting	Open-bed truck	Simple random grab sample with trier (SW-846, Section 1.2.1.5). One sample per depth level.	1. Wear rubber gloves, apron, shoes, mask, and breathing apparatus. 2. Use linear polyethylene sample container. 3. Toxic.
D-1	Bottom tars from phenol production	55-gallon drum	Simple random grab sample with Coliwasa (SW-846, Section 1.2.1.1). Sample cube root of total number of containers per shipment.	1. Wear goggles, mask, rubber gloves, apron, and boots. 2. Place sample in glass container with teflon cap. 3. Get one mid-level sample. 4. Toxic.
L-1	Leachate, homogeneous liquid	Sump	Simple random grab sample with Coliwasa (SW-846, Section 1.2.1.1). Sampling dependent on volume of leachate collected in sump.	1. Do not collect during rainfall. 2. Put in linear polyethylene container. 3. Potentially toxic.

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[1] Typically, off-spec materials are not analyzed.
[2] Source of cube root equation: ASTM D140-70.

Analysis

Table 3 identifies the analytical methods chosen for periodic waste characterizations and waste shipment screening. The table also provides a rationale for selecting each parameter and the frequency at which each stream is recharacterized. The recharacterization frequencies selected are based on a ranking exercise that considers the criteria discussed in Section 4. [See Appendix E of this manual for an explanation of this ranking exercise.] The details of the ranking exercise are not included since they take the waste generator's history of performance into consideration. The details are available upon request. Should recharacterization analyses prove that the waste is not safely manageable onsite, we will reject it.

All analyses are performed in-house. QA/QC procedures for sample analysis are discussed in the appendix.

TABLE 3. WASTE ANALYSIS INFORMATION

Stream[1]	Parameter[2]	Test Method[3]	Detection Limit (μg/L)	Rationale for Parameter Selection
A-2, B-1, C-1, L-1	*pH	SW-846, pH Method 9040 (Electrode)	-	Identify restricted corrosive wastes. Waste verification.
A-2, B-1, C-1, D-1	*Free liquids	SW-846, Method 9095 (Paint Filter Test)[4]	-	Identify restricted free liquids.
A-2, B-1, C-1, D-1, L-1	*Water content	ASTM D95 (Distillation) or D176 (Centrifuge)	-	No more than 30% water is allowed in waste to maintain integrity of landfill structure and minimize leachate generation.
D-1	*Flash point	SW-846, Method 1010 (Pensky-Martens Closed Cup)	-	Identify restricted ignitable wastes.
A-2, B-1, C-1, D-1	*Reactivity	U.S. Gap Test or U.S. Internal Ignition Test[5]	-	Identify restricted reactive wastes.

TABLE 3. (continued)

Stream	Parameter	Test Method	Detection Limit (µg/L)	Rationale for Parameter Selection
A-2, B-1, C-1, D-1 L-1	EP toxic metals			Waste verification.
	Arsenic	SW-846, Methods 3050/ 7060 (AA, Furnace)	1	
	Barium	SW-846, Methods 3050/ 7081 (AA, Furnace)	2	
	Cadmium	SW-846, Methods 3050/ 7131 (AA, Furnace)	0.1	
	Total Chromium	SW-846, Methods 3050/ 7191 (AA, Furnace)	1	
	Lead	SW-846, Methods 3050/ 7421 (AA, Furnace)	1	
	Mercury	SW-846, Method 7471 (AA, Furnace)	0.2	
	Selenium	SW-846, Methods 3050/ 7740 (AA, Furnace)	2	
	Silver	SW-846, Methods 3050/ 7761 (AA, Furnace)	0.2	
A-2, B-1, C-1, D-1	*Oxidizing agents	Iodide, Starch Paper Test[6]	-	Identify restricted oxidizing wastes.
A-2, B-1, C-1	*Cyanide	SW-846, Method 9010 (Titration)	-	Identify restricted cyanide wastes in aqueous-based media.

TABLE 3. (continued)

Stream	Parameter	Test Method	Detection Limit (µg/L)	Rationale for Parameter Selection
A-2, B-1, C-1,	*Sulfide	SW-846, Method 9010 (Titration)	1,000	Identify restricted sulfide wastes in aqueous-based media.
A-2, B-1, C-1, D-1	*Radioactivity	Radiation Detector	-	Identify restricted radioactive wastes.
D-1, L-1	Phenol	SW-846, Method 8040 (GC/FID)	-	Verification of waste.
D-1, L-1	PAH	SW-846, Method 8100 (GC/FID)	-	Verification of waste.
D-1	*PCB	SW-846, Method 8080 (GC/ECD)	0.065 (for one isomer)	Identify restricted PCBs in an organic media.
A-2, B-1, C-1, D-1, L-1	Volatile and semivolatile organic constituents.	SW-846, Methods 8240 and 8250, respectively (GC/MS)	Based on constituent	Identify any hazardous organic constituents that are present.

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[1] Recharacterization Frequency: A-1-none; B-1-quarterly; A-2 and D-1-semiannual; C-1-annual.
[2] Asterisk denotes key parameter measured with each shipment.
[3] SW-846 "Test Methods for Evaluating Solid Waste" July 1982.
ASTM - American Society for Testing and Materials.
[4] [Author's note: This test method will be included in the next edition of SW-846.]
[5] [Author's note: These explosivity tests are currently under development by the Bureau of Mines for EPA.]
[6] Iodide, Starch Paper Test: "Design and Development of a Hazardous Waste Reactivity Protocol," EPA-600/52-84-057. 1984.

APPENDIX

QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

Goal of Program

Our program's goal is to collect representative waste information in order to assure that the wastes we handle can be safely retained by our landfill. We accomplish this by making sure that --

- no restricted wastes are accepted,
- significant waste characteristics are verified, and
- waste incompatibilities are identified so those wastes are disposed in isolated cells.

We generate a great deal of data at our facility, and we carry out our quality assurance/quality control program to the fullest to assure that accurate and precise data are obtained.

Sampling Program

Two of our personnel have been trained to sample waste shipments. This Part B application contains a chapter on our training program. The employees' sampling skills are observed quarterly by our operations manager. Sampling equipment is inspected for decontamination and operability before each shipment is sampled. Each inspection is documented, noting any problems and corrective actions taken.

Since many wastes and generators are dealt with at our facility, we label all sample containers (see Figure A-1) and maintain a field log of vital sampling information (see Figure A-2) before a designated driver carries the samples (with an accompanying list of those samples) to the laboratory.

Analysis Program

Our lab personnel have been trained to perform the analytical methods outlined in Table 3. (See the Part B Training Program section.) Their analytical skills are checked with blanks or standards that are included with each analysis.

Collector L. Russell Sample No. A-2-1

Place of Collection Truck receiving area

Date Sampled July 22, 1983 Time Sampled 10:15 a.m.

Field Information Sample taken from forward access port - vertical core sample. Sample appears typical.

Figure A-1. Sample container label.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

FIELD LOG

Date 7/22/83

Sample Identification Number A-2-1

Time 10:15 a.m.

1. Waste Identification
   a. Waste Type Pigment sludge
   b. Facility Waste Number A-2
   c. Suspected Composition Sludge with lead and chromium

2. a. Waste Generator Alpha Color, Inc.
   Address Alphaville, USA

   b. Generation Process Molybdate orange pigment - wastewater treatment plant sludge

3. Purpose of Sampling

   Incoming shipment screening

4. a. Sampling Point Location Closed-bed truck
   b. Description

   Forward access port - vertical core sample

5. a. Number of Samples Taken One

   b. Volume per Sample One liter

6. Any Field Measurements Taken No

   Parameter

   Measurement

7. Observations During Sampling Sample appears typical

8. a. Sample Destination In-house laboratory

   b. Means of Transport Truck

Signature of Sampling Person: L. Russell

Figure A-2. Field log.

Source: "Test Methods for Evaluating Solid Wastes" SW-846, July 1982.

Lab personnel document receipt of each sample. Waste samples are stored until analysis based on their expected content. Screening samples are analyzed as soon as possible to avoid delays in shipment processing. Characterization/recharacterization samples are analyzed depending on their storage life. Sample identification numbers are assigned to replicates analyzed. The quality assurance/quality control procedures for analysis follow those outlined in each test method of SW-846, "Test Methods for Evaluating Solid Waste," and other EPA-approved methods. All test results are documented on the characterization form shown in Figure 1 and are kept on file.

Analytical equipment is inspected and serviced semiannually in addition to routine checks before each analysis. Leftover samples are returned to their original containers.

APPENDIX B
REFERENCES

1. Identification and Listing of Hazardous Waste Under RCRA, Subtitle C, Section 3001. Listing of Hazardous Waste (40 CFR 261.31 and 261.32). NTIS PB81-190035, U.S. Environmental Protection Agency, Washington, D.C. 1980. 853 pp.

2. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. SW-846, 2nd Edition, U.S. Environmental Protection Agency, Washington, D.C. 1982.

3. Standard Methods for the Examination of Water and Wastewater, 15th edition. American Public Health Association, Washington, D.C. 1980.

4. A Method for Determining the Compatibility of Hazardous Wastes, EPA-600/2-80-076, U.S. Environmental Protection Agency, Cincinnati, Ohio, 1980. 149 pp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

5. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal with Toxicity and Hazard Data. The International Technical Information Institute, Tokyo, Japan, 1976. 591 pp.

6. Hazardous Waste Land Treatment. SW-874, U.S. Environmental Protection Agency, Washington, D.C. 1983. 671 pp.

7. EPA Memorandum. "Guidance on Petroleum Refinery Waste Analyses for Land Treatment Permit Application." April 3, 1984.

8. Permit Applicants' Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities. SW-84-004, U.S. Environmental Protection Agency, Washington, D.C. 1983. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

9. Guidance Manual for Hazardous Waste Incinerator Permits. SW-966, U.S. Environmental Protection Agency, Washington, D.C. 1983. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

10. Design and Development of a Hazardous Waste Reactivity Testing Protocol. EPA-600/52-84-057, U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinati, Ohio. Available from the National Technical Information Service (NTIS No. PB84-158807).

APPENDIX C

HOW TO USE A RANDOM NUMBERS TABLE FOR WASTE SAMPLING

This appendix has been developed to demonstrate how hazardous waste can be sampled without any bias by the sampler. It is important that the sample you obtain is representative of the actual waste's chemical and physical characteristics. To avoid taking many samples that are expensive and tedious, you can, with the aid of a random numbers table, select areas in a waste collection that should be just as representative of the waste.

The following example explains how to use a random numbers table.

Let us assume that we have 30 drums stored. We assign a two digit number to each drum ranging from "01" to "30". Now refer to Table 1, "Random Numbers". We will use these numbers to decide which of our 30 drums to sample. We select the point at which to begin in the table by using our date of sampling. For example, if we sample on October 14, 1983, we move to the 10th horizontal set of numbers. (October is the 10th month of the year.) We then move to the 14th set of vertical numbers (the 14th day of the month). Next we use the years, "83". We start with the first number on the first row of this set of 10 digits and count 8 digits to the right. At the eigth digit, we then count down 3 digits. This is our starting point. We read the numbers from left to right in sets of two digits since the maximum number of barrels (30) has two digits. Any number greater than 30 is ignored. If any number is repeated, each repeat is ignored. If we come to the end of a row on the page, we return to the far left on that same page and begin reading numbers left to right in the next row below it. We continue selecting two digit numbers between "01" and "30", inclusive, until the number of drum samples required has been fulfilled.

If we wanted six samples, we would begin with --

248 83533 25440

17803 18184 10510

[Six was chosen as a sample number only for the purpose of this demonstration. It does not mean that everyone should sample six out of every thirty drums.] Therefore, drums numbered 24, 25, 01, 03, 18 and 05 will be sampled. Figure 1 displays the barrel numbers selected.

This random numbers method can also be used for other waste sampling scenarios, e.g., surface impoundments. These other scenarios may entail dividing your waste collection into a three-dimensional grid. Figure 2 displays how such an area could be numbered for three levels of depths. The number of levels required depends on the waste and on the facility design. "Test Methods for Evaluating Solid Wastes" (SW-846) should be reviewed for EPA's latest guidance on determining the total number of points to sample.

TABLE 1. RANDOM NUMBERS

Day	1(21)	2(22)	3(23)	4(24)	5(25)	6(26)	7(27)	8(28)	9(29)	10(30)
Month 1	53872 34774 04226 62404 28666 44190 63817 30279 22359 16442	19087 81775 71577 00984 75524 62038 14088 86434 83879 47486	71440 12082 56056 32404 21423 46281 16183 06401 19838 32252	75092 34608 87641 53392 92238 96306 90586 80292 39560 95851	75448 13148 92561 33388 72606 80601 54555 47371 36758 36141	16972 42181 74938 79042 78075 53671 76744 26190 12273 69293	87945 94104 38473 89672 81047 92759 21649 79753 23383 59365	95701 00743 45752 35715 94519 59473 21287 17698 18258 54530	75411 51930 89537 78155 91679 90536 39490 00533 47274 69686	54869 98991 09851 24983 41676 35230 34823 08134 55081 28731
2	50968 28728 39652 24245 35493 00529 75687 53919 31509 93521	83525 16031 96617 91200 69632 29684 80439 20534 10681 44124	77583 65578 10769 52386 80284 87828 96185 72345 88345 84969	84794 51367 39559 75921 72418 80950 96391 52625 88768 48819	32535 83834 49375 22847 86311 34016 50866 45132 22311 41235	30239 23081 41177 77163 07715 88600 16855 47454 21985 61979	09526 26055 38252 10349 69730 78912 98638 15189 02979 98092	87099 41372 49511 17540 19642 39764 87345 80509 41184 73815	55542 32754 61781 32769 47146 19472 33392 50866 57939 91057	87317 94638 51662 55606 84012 08887 17629 28208 04860 66667
3	40389 76282 59244 54664 99876 17075 06457 50072 14297 07687	37506 60661 63424 97899 40934 08912 18060 71023 05517 10362	23295 67357 44153 69251 96196 58503 84349 40984 35783 62236	95419 10864 08781 18604 63613 24486 59487 77782 63764 45542	87833 09152 02312 21658 98092 45672 32107 53770 68889 03862	77411 98433 19453 18731 03381 35119 11659 27315 35032 14283	42302 86602 01039 18933 30355 08287 09204 26213 20642 15311	26596 64175 92188 83767 00448 32800 57325 51470 36238 12079	64359 97570 56148 56261 24106 04054 56108 23141 67596 00017	64437 55592 79920 78514 70572 71063 16121 53925 51789 90737
4	51661 57130 5345 11788 4808 01512 191 01602 39001 77727	97442 29590 16117 09698 62819 27689 96950 41536 33095 58785	21634 79772 24409 05079 63744 11023 39974 88287 29179 45421	73801 70122 76603 57563 11184 87679 83546 69187 71416 20418	46467 47152 33461 46791 22218 70139 45539 78263 38558 78700	32061 51250 81855 16888 48422 09247 86190 56195 90627 37048	39825 08554 24630 15077 43406 16093 31409 88248 50285 69189	88716 40945 47256 08529 01168 28523 52436 70161 97489 83007	68579 33784 54837 24161 31406 49360 98500 74702 31477 13908	62025 32535 95621 53483 99243 85090 99546 74570 97472 74448
5	72346 55617 19094 64359 82247 77127 75968 18386 01963 38095	14714 21930 89829 10942 01652 50774 31874 52249 99960 91307	14851 38209 53101 37758 04970 83300 21015 20365 99654 74279	52202 03979 29583 26792 33760 22172 57475 32756 80145 53303	05970 74483 42840 45872 67516 62135 58268 75739 11870 50485	60103 76739 09606 69465 62479 29610 40232 52840 10690 55550	57644 56746 16536 94055 03235 51050 02512 99258 81275 78369	63005 08804 86328 56533 15855 66828 09327 35073 33658 47000	47081 65928 16670 57295 08115 16166 86030 29933 89425 60573	65045 58629 26249 18524 32854 74206 00528 67359 81137 25474
6	64828 15817 64347 61578 54746 52337 22241 41501 11906 20043	80923 55226 44160 06266 84826 39012 02993 99340 10415 44425	51893 93362 35118 52558 59118 19851 91044 67268 31712 54831	15757 47430 56436 96155 10156 78167 51088 12751 85591 62237	84855 95822 10293 67506 41473 99025 74008 33773 88797 14382	73958 38949 56554 57926 35676 20333 01383 85677 29448 88487	99568 72713 41529 00619 77622 93718 96572 16401 05814 82402	22665 03244 51972 09442 57255 09780 31379 88519 42132 85708	17399 83950 60298 81066 26798 60083 41325 33938 89754 57495	66820 03704 28362 41165 58939 45691 36342 03327 57655 78644
7	76637 07609 93896 47120 75292 88232 98792 29828 65751 91049	95378 95590 98926 30516 14360 12455 10577 48184 94127 47558	86909 50609 28136 49458 13656 65736 29433 98278 99880 79667	99008 99042 84145 79205 70428 66917 22543 76155 86254 72797	50364 36664 79517 93446 64412 38502 82107 22066 67117 44699	56863 94737 20269 34456 06790 99803 73690 79726 76222 20006	68661 43498 48608 11787 86439 94235 06492 77431 98660 88690	33376 81659 86036 88290 48560 62912 49864 69775 01190 05588	07422 58435 17463 66628 82302 43198 46450 02122 76651 83461	24855 15523 03033 80771 97087 97104 09083 92746 11987 80756
8	72064 62102 01227 35821 44768 56504 69838 91226 01800 39313	39155 79462 80607 61734 13993 59701 85736 72247 57730 84410	82975 02638 02600 45564 88238 92483 64099 86305 47637 81369	00302 79476 72344 71034 09497 66058 49877 76215 51830 43536	72656 84003 48370 96826 36651 37927 66980 30228 58937 91901	18434 21893 20463 75133 27105 77095 47736 56338 60938 13970	80472 19499 41713 84279 72016 23683 07546 36084 90288 79457	80423 58643 56045 79079 01386 40381 73126 33364 50343 92054	27088 66458 20212 91560 74673 11811 78730 47282 12541 93216	78358 56606 60548 95128 36625 62958 76795 95719 38624 37392
9	11756 45441 39055 86614 88085 93172 12648 27948 16254 87661	59948 57975 53643 62909 68311 39164 76750 19915 66181 68609	92422 70057 27198 04454 42012 10447 66815 34015 58626 58428	50210 30345 33789 86463 45933 28844 43011 27150 75051 27558	55912 31638 66603 48081 36844 57684 94264 89516 49463 66646	02743 59982 74802 59354 06933 78651 40345 80092 70055 98685	92806 62853 91213 26293 45636 77509 50587 18535 10244 11760	39755 42550 18112 93831 28610 34307 19001 82179 21952 73985	31081 38360 01473 10798 68045 15107 12572 77589 68903 66934	35712 78632 18229 18642 62935 34149 33459 35130 42442 07608
October 10	69682 19109 61336 86663 65727 66488 55705 34418 95402 51746	94189 94626 13010 40412 12304 70011 99410 32635 98184 38830	09299 10649 50139 30769 93324 58764 42984 40981 97590 00066	55405 54571 13048 61407 87274 43103 91750 27431 82770 42325	57855 54921 41056 60510 96002 06984 05142 77950 28778 83571	34552 76373 45253 86947 71558 21692 95474 76468 34619 91898	40928 93696 42417 28778 84077 17814 12019 04274 28499 00279	97711 15818 14936 94099 33316 49494 01893 23930 35351 87736	31004 03263 90775 42001 31817 90127 88771 31142 83909 43736	05626 07460 86675 62770 39485 92302 65859 28948 19258 95068
11	79228 94510 48103 56760 70969 27677 69931 20237 37208 22741	57711 64366 82564 33649 99621 63065 75246 59124 41946 74109	89040 43278 35176 32278 73194 70462 12484 22012 03760 24094	69072 22003 51357 05489 19316 77945 79731 82435 40210 76617	89465 61483 47462 55931 45004 39895 56301 99752 52317 50643	44546 75524 22917 96024 33043 31433 99357 34593 01072 31679	68535 77434 04784 03809 47833 75234 21688 64216 80961 34029	18543 15479 52788 83577 74539 38529 85938 51742 56463 09594	58850 73802 02269 68632 57593 45997 12898 09737 11939 51777	10636 82735 23310 46261 71749 28666 61504 18946 64796 52432
12	60151 92327 46210 47674 55399 48142 23677 64950 41947 70066	85150 27728 53747 95354 12284 95298 97041 43088 90311 17133	64813 47667 67757 75477 56399 61358 80143 34294 11674 00826	66078 93628 26396 09592 87541 12998 91468 01066 75760 37586	95240 03808 96239 50854 79639 63633 90350 78891 33621 14199	90838 50179 35914 39441 87047 77284 93727 46613 37439 50362	42064 62987 93149 67957 12753 45644 48045 49655 44171 18495	13072 84227 16955 39960 47843 55781 28383 37200 57370 77691	24060 59438 26142 45600 06672 57548 98473 56808 28006 55318	05695 38136 75486 74103 84706 25453 86774 07305 39723 25299

Source: *Statistics with Applications to the Biological and Health Sciences.* R. D. Remington and M. A. Schork, 1970.

TABLE 1. RANDOM NUMBERS (con.)

	Day	11(31)	12	13	*14*	15	16	17	18	19	20
Month	1	98892 53633 93358 77381 28982 24583 51303 70209 08457 10085	33909 81674 21912 24373 88896 31137 42174 10757 35741 79416	91956 84531 26372 12044 87512 33216 98531 35725 72457 59502	60422 55574 43234 08503 29665 26014 68203 61239 46986 09051	31670 61059 86716 08095 02919 17639 26705 43916 70963 19759	30807 55558 75104 23682 06180 62724 22093 34834 13173 64783	56026 97398 78756 72728 36835 80288 66117 36252 20434 11929	21723 86560 85940 57290 25075 32609 82717 50585 18849 26211	52617 07771 75507 78715 33312 21348 43639 79999 77375 49561	61886 48234 01426 02310 87710 55457 07414 84003 96747 67007
	2	20698 80918 27142 41186 36775 63628 02360 51679 36744 64697	90073 78320 32273 81087 70856 43164 79600 23297 08331 50201	83675 78361 67398 16793 88426 31415 36434 17174 56303 09171	49929 70493 98342 83820 37514 24870 00109 02731 55995 60232	92247 04318 48765 24164 53683 05311 05909 58959 31305 30689	75273 36105 89849 65756 91108 43562 51843 01542 07644 23564	55265 15653 44454 04602 18883 16569 17831 12954 85464 62947	82270 99216 14292 74458 49599 73871 94913 39583 92571 89377	27105 60088 57777 35934 67101 12054 94969 61146 85004 84654	06056 97377 05160 26359 56493 15981 35907 72184 20465 86212
	3	66482 04302 76375 41339 95772 72925 59013 81632 52392 04440	29770 46201 63940 37820 19454 63712 85000 39180 45628 34976	04588 42575 29283 94564 21401 96665 99975 73253 92012 16596	99318 84406 96598 00619 77750 21218 46534 59083 28596 15493	83405 21184 60468 97375 02990 50796 60243 27664 30754 48760	38608 83374 43164 28909 80933 52950 67690 96765 68579 17014	74032 62183 88624 14992 45646 36635 69250 19344 25362 15114	08740 05279 85359 10193 05085 28053 47855 43489 30982 27230	30455 31032 32491 14769 27596 54873 77479 62418 29052 71515	71512 16476 63694 92640 63476 65823 54079 40369 83369 46776
	4	08027 07629 27284 39416 20513 38581 36076 12821 60679 43862	04339 77570 37313 03508 82309 69951 68723 37934 43675 03653	47155 77128 71443 42543 82658 60958 62818 64157 21060 81096	24498 67455 73335 68620 18290 60534 54590 98263 71332 28930	06320 82004 87559 77927 30741 89647 70109 06755 44207 03354	46353 39733 30039 09532 89200 92772 58118 57942 97230 33027	44677 50133 52215 09164 42195 91634 14307 68214 70166 43232	26623 15979 20930 88230 39272 46462 76093 47484 98802 70715	10651 04263 43403 63230 76835 27755 24468 91764 30216 35586	34087 67005 83525 93550 03151 75692 52907 16675 18909 79658
	5	49416 58370 65757 39149 17379 77731 00757 13129 68276 79035	63738 87515 11780 92494 65133 44979 09648 07644 78273 83412	39290 87656 41335 35835 90939 29184 81689 68088 97328 81003	36130 23490 69882 56431 76614 58007 34882 04971 65938 85510	30963 57350 05091 01981 34873 83816 27565 66577 78367 29316					
	6	64716 91696 83695 11496 58275 66797 58005 84170 99993 80033	45448 92281 57066 48153 35380 41155 29999 23631 03810 07214	73854 67432 74754 56383 44389 94560 93032 41592 42067 76669	52145 41582 09253 65456 42074 31178 55688 78599 19686 64064	81549 82434 32438 96357 27967 12666 59902 21568 67141 80520					
	7	31692 51607 82997 58320 05043 40582 75781 35768 21033 15175	89056 74472 04852 52595 46051 60261 70475 00601 30741 45814	91284 20263 95514 56543 04926 82256 18378 32077 92222 16704	16039 94191 06636 61291 47375 87507 36523 30843 00197 51267	33767 73915 67504 57203 05112 88439 07057 78326 33224 40276					
	8	99092 60991 07204 93373 85859 97254 30497 91407 09725 18075	12571 71753 85112 29610 07771 21393 72900 15699 45852 54968	65214 33885 30375 64836 64657 42013 58653 38053 43743 82050	82939 50723 13459 08235 12753 03028 25072 48698 78412 79456	89987 69761 67650 72930 24224 24918 88083 48040 95032 10984					
	9	95330 01985 09760 32388 01534 81967 11234 59350 71656 48762	24128 60514 05601 49923 15337 95831 48368 57195 80221 59683	42539 91907 66126 54146 84643 40792 36287 03046 27504 21121	25694 37097 67213 52234 47562 95494 87136 36057 94711 11807	39566 24043 48381 89442 62087 18064 93913 70080 80382 48359					
October	10	34708 05374 47132 62839 55685 93302 17803 18184 55045 17219	60104 43178 82198 92445 43019 45861 10510 27159 66737 59080	97247 24875 60650 76219 95493 16106 83008 20544 78489 12626	26259 67622 02772 48651 12783 37248 41665 99439 60661 53733	14657 80354 66449 89213 83533 25440 70606 28974 70062 14289					
	11	01923 33647 07202 76476 68825 68242 65525 06496 80519 33515	98442 59293 71888 54845 95750 11033 17446 41378 97373 43064	83318 33425 17468 41964 58634 78411 32368 82019 16221 99697	76412 87062 68694 59662 08523 19313 66101 56733 37951 07947	01295 11083 55905 26898 29327 47526 43308 82641 12935 49391					
	12	64200 96929 30156 29121 50457 14282 53764 83212 81727 35572	26044 49283 75874 42399 89098 66717 26675 64184 93469 36825	56545 67200 41121 90643 14753 73356 64455 29023 81882 95083	21325 85056 19585 06364 47781 34165 03181 13674 68323 14965	51345 06309 47203 19579 82842 00121 08838 83829 34166 32351					

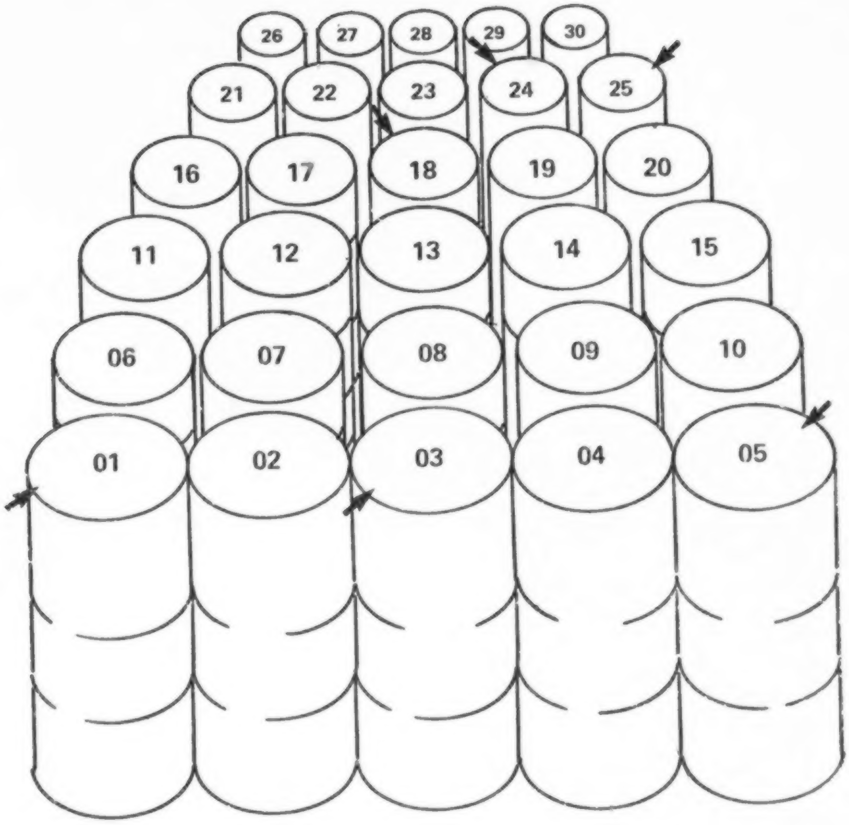
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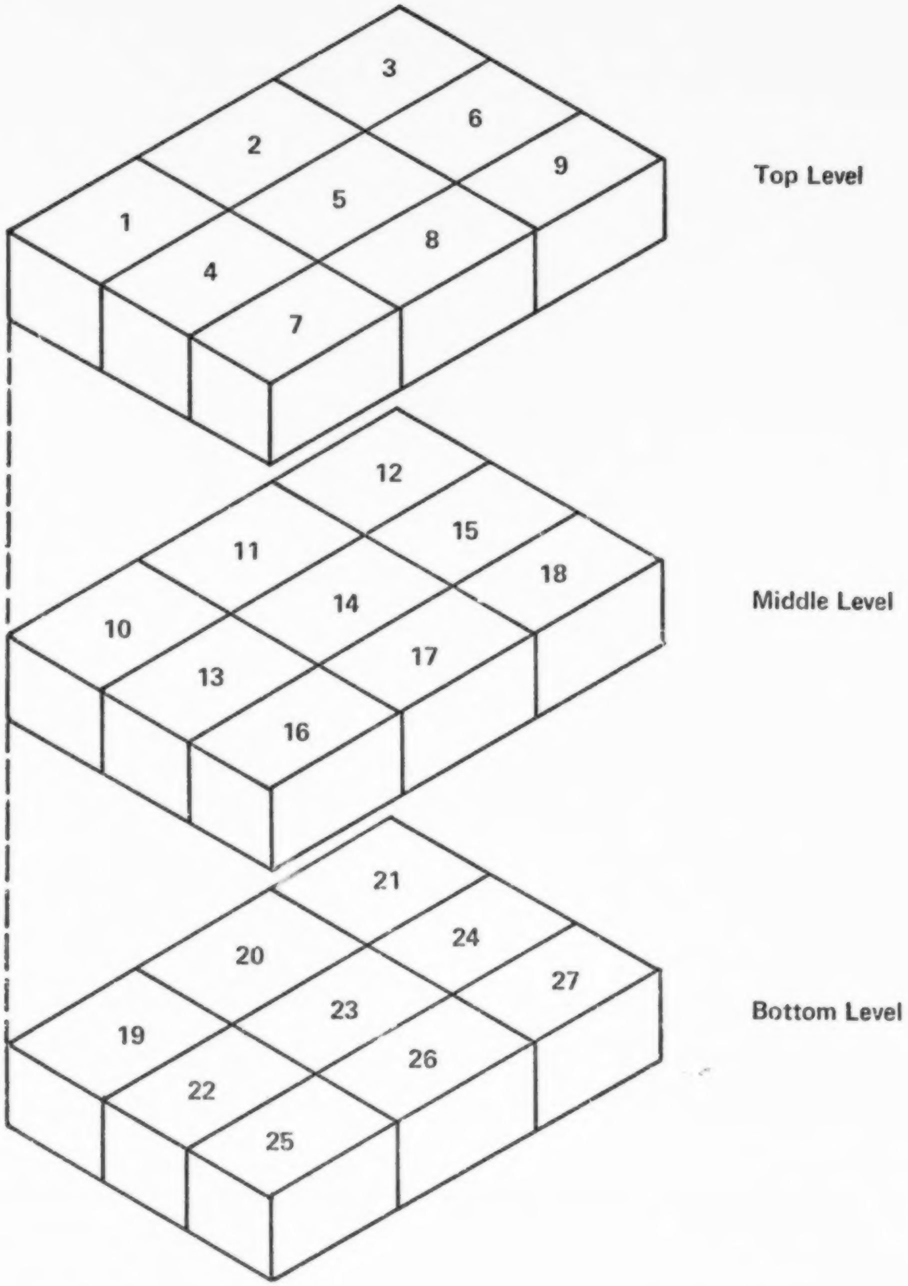
Figure 1. Display of drums selected for sampling based on a random numbers table.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2
6
9
1
5
8
4
7
Top Level
12
11
15
18
10
14
17
13
16
Middle Level
21
20
24
27
19
23
26
22
25
Bottom Level

Figure 2. Three dimensional grid for selecting sampling cells.

APPENDIX D

DRUMMED WASTES - ESTIMATING SAMPLING SIZE

Designation: D 140 - 70

AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Methods of
SAMPLING BITUMINOUS MATERIALS[1]

This Standard is issued under the fixed designation D 140; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

12. Sampling Semisolid or Uncrushed Solid Materials

12.1 *Drums, Barrels, Cartons, and Bags*—Where the lot of material to be sampled is obviously from a single run or batch of the producer, one package shall be selected at random, and sampled as described below. Where the lot of material to be sampled is not obviously from a single run or batch of the producer, or where the single samples selected as described above fails on test to conform to the requirements of the specifications, a number of packages shall be selected at random equivalent to the cube root of the total number of packages in the lot. The following table is given, showing the number of samples to be selected for shipments of various sizes.

Packages in Shipment	Packages Selected
2 to 8	2
9 to 27	3
28 to 64	4
65 to 125	5
126 to 216	6
217 to 343	7
344 to 512	8
513 to 729.	9
730 to 1000	10
1001 to 1331	11

Samples shall be taken from at least 3 in. (76 mm) below the surface and at least 3 in. from the side of the container. A clean hatchet may be used if the material is hard enough to shatter and a broad, stiff putty knife if the material is soft. When more than one package in a lot is sampled, each individual sample shall be not less than ¼ lb (0.1 kg) in weight. When the lot of material is obviously from a single run or batch of the producer, all samples from the lot shall be melted and thoroughly mixed, and an average 1-gal (4-dm^3) sample taken from the combined material for examination. In case more than a single run or batch of the producer is present and the batches can be clearly differentiated, a composite 1-gal sample shall be prepared for examination from each batch. Where it is not possible to differentiate between the various batches, each sample shall be examined separately.

APPENDIX E

A RANKING METHOD TO SELECT FREQUENCY OF WASTE RECHARACTERIZATION

This ranking method has been developed to aid in selecting the appropriate frequency of waste recharacterization. It is intended primarily for facilities that receive wastes from an offsite generator; however, it may also be modified for use by onsite facilities. The method allows several criteria to be taken into consideration in determining the frequency of recharacterization. It should always be kept in mind that the objective of recharacterization is to minimize the potential for any environmental contamination at a facility by an unmanageable waste.

Figure 1 is a worksheet designed to rate wastes (especially those generated offsite) on the basis of the likelihood that the character of the waste will be drastically altered between shipments. A worksheet should be prepared for each generator and their waste that is served by the facility. The sheet lists five criteria to be evaluated--

- The potential for restricted wastes to be combined in a waste shipment that is normally permitted.
- The design limitations of the hazardous waste management process.
- The variability of a waste's composition among shipments.
- The likelihood of the waste undergoing changes that will affect its manageability.
- The prior history of the waste generator performance and reliability.

Weighting factors ranging from one to five can be assigned to each of these criteria to assess its relative importance (5 is the most important). That is, how significant of an impact would an episode that falls under one of these criteria have on the facility's operation; for example, a generator mistakenly sends a shipment of wastes containing oxidizing agents rather than the contracted spent solvent. These weighting factors will vary depending upon the hazardous waste process under consideration and the limitations of the facility's permit. It is often helpful to prepare a list of reasons why criterion has been assigned a given weight.

After assigning weights, probabilities ranging from 0 to 4 should be chosen for each criterion indicating the likelihood of a given generator and waste meeting that criterion. For example, what is the likelihood of a contracted waste having a restricted waste mixed in its shipment. It is again helpful to prepare a list of reasons why a given probability is selected.

FIGURE 1. RECHARACTERIZATION DECISION CHART

	Weight	Probability					Product
		0	1	2	3	4	Actual (Max.)
Restricted Waste Combined in Shipment							
Process Design Limitations							
Variability of Waste Composition							
Chemical/Physical Instability of Waste							
Generator's Performance History							

TOTAL ACTUAL (MAXIMUM)

Weight = 1 to 5 with 5 being the most important

Probability = 0 to 4 with 4 being the most probable

$$\frac{\text{TOTAL ACTUAL}}{\text{TOTAL MAXIMUM}} \times 100 = X$$

The products of each criterion weight and probability should be totaled in the far right column of the worksheet along with the maximum total possible. Incorporating these totals into the worksheet equation yields a value of "X" that can be used in the following chart to determine the percent of a generator's shipments that should be recharacterized each year.

X	% of number of shipments recharacterized over one year[1]
100	100%
75 - 100	75%
50 - 75	50%
25 - 50	25%
0 - 25	10%

This chart assumes that a facility receives at least one shipment of a given waste each year from each generator. It is recommended that at least the first shipment be recharacterized, so one can document waste characteristics in case future shipments are not received.

Figure 2 is an example of how the worksheet would be completed.

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[1] Distribute sampling and analysis of shipments should be well-distributed over the year.

FIGURE 2. EXAMPLE RECHARACTERIZATION DECISION CHART

	Weight	Probability					Product
		0	1	2	3	4	Actual (Max.)
Restricted Waste Combined in Shipment	5			X			10 (20)
Process Design Limitations	5		X				5 (20)
Variability of Waste Composition	3				X		9 (12)
Chemical/Physical Instability of Waste	2	X					0 (8)
Generator's Performance History	2					X	8 (8)
TOTAL ACTUAL (MAXIMUM)							32 (68)

Weight = 1 to 5 with 5 being the most important

Probability = 0 to 4 with 4 being the most probable

$$\frac{\text{TOTAL ACTUAL}}{\text{TOTAL MAXIMUM}} \times 100 = X$$

$$\frac{32}{68} \times 100 = 47 = X$$

[As seen in the table on page E-2, the value of "47" falls within the "25 to 50" range; therefore, 25% of the number of shipments would be recharacterized during the year.]

*U.S. GOVERNMENT PRINTING OFFICE : 1984 0-461-218/546